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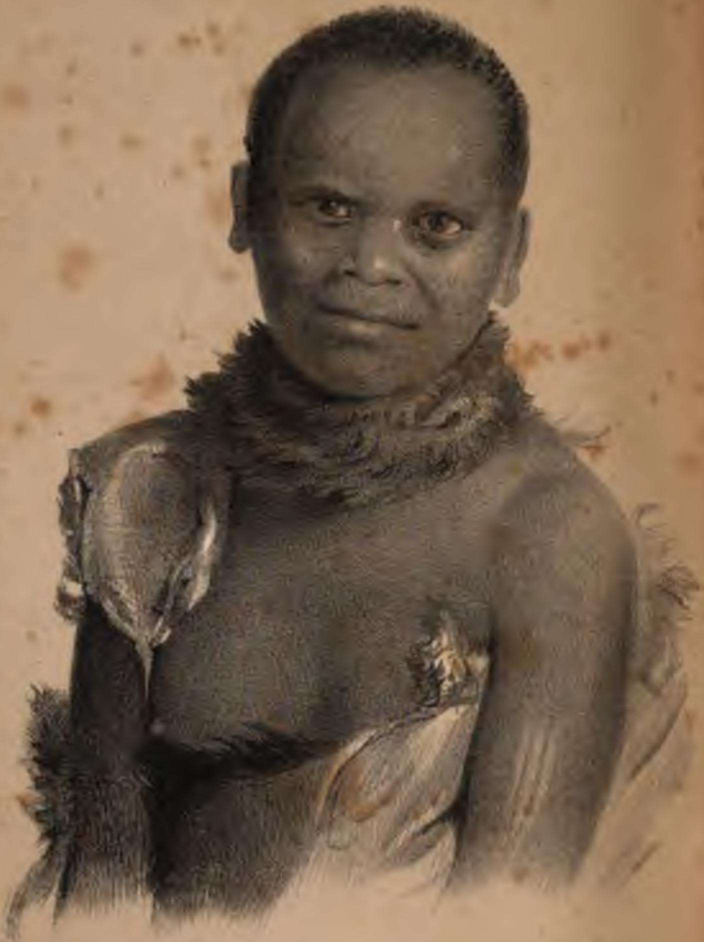

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JENNY.

Native of Port Sorell;

VAN DIEMEN'S LAND

PHYSICAL DESCRIPTION

OF

NEW SOUTH WALES

AND

VAN DIEMEN'S LAND.

ACCOMPANIED BY

A GEOLOGICAL MAP, SECTIONS, AND DIAGRAMS,

AND

FIGURES OF THE ORGANIC REMAINS.

BY

P. E. DE STRZELECKI.

> "..... The duty really is, not to refute the experiments of others, nor to show that they are erroneous, but to discover truth, and that alone. It is startling when we reflect that all the time and energy of a multitude of persons of genius, talent, and knowledge are expended in endeavours to demonstrate each other's errors."—*Liebig's Chemistry of Agriculture, &c. &c.*

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TO

CAPT. SIR JOHN FRANKLIN, R.N.

COMMANDING THE NORTH POLAR EXPEDITION.

MY DEAR SIR JOHN,

Fully impressed with the idea, that a token seldom corresponds, and never is expected to correspond, in value to the sentiments it is meant to testify, I still take the liberty of inscribing to you this slight but most sincere tribute, not only of my regard and esteem, but of a gratitude far exceeding the ordinary sense of obligation, for those courtesies, and that hospitality, which, in common with every visitor, I experienced from you in Hobart Town.

In my case, indeed, I have to acknowledge far more than mere conventional civilities. When, after completing the exploration of New South Wales, I ventured on that of Van Diemen's Land, I was welcomed, on my arrival at Launceston, by a kind letter of yours, which is now before me, and which insured to me, a stranger at that time, all the protection and assistance which the pursuit I was engaged in could require. The two years and a half which followed, were often marked by instances of that assistance, and always by the uninterrupted manifestation of a most kind and friendly interest, on the part both of Lady Franklin and yourself; and even when far away from Van Diemen's Land, in other climes and countries, the influence of your friendly disposition followed me still, as on my return to England I found myself honoured by an address from the Tasmanian Public, headed by your name, and which, from the motives which prompted it, will form the proudest memorial of my life.

Whilst acknowledging my obligations to you, permit me at the same time, my dear Sir John, to offer you in all sincerity my most warm and cordial wishes for the success of that important Expedition which in a few days will leave the shores of England under your command. Nearly eighteen years have elapsed since last you visited the Polar Regions,—three hundred since the first attempt was made to ascertain the practicability of navigating round the Northern Boundary of the American Continent: May the enviable lot of solving this still pending geographical problem fall to your share! and may that good fortune be united with a prosperous voyage, and a safe return to your country and your friends!

Believe me, &c. &c.
My dear Sir John,
Yours most sincerely,
P. E. De Strzelecki.

London, May 13. 1845.

PREFACE.

In the course of my travels and voyages round the globe, and which occupied twelve years, I had explored or visited both North and South America, part of the West Indies, the South Sea Islands, New Zealand, New South Wales, Van Diemen's Land, the Javanese Islands, part of China and the East Indies, and Egypt. On my return to England, I had the honour to receive, through the hands of Francis Corbould, Esq., the following address from the Tasmanian Public, dated Van Diemen's Land, June, 1843: —

" *We, the undersigned, cannot suffer you to depart from our shores without presenting to you the assurance of our sincere regret. The benefits which you have conferred upon our country have added other motives to those of private friendship, which call for a public and united expression of our esteem.*

" *We are conscious that much is owing to your scientific knowledge, and to your indefatigable exertions; much that will, from henceforth, advance the progress of science, and the developement of the natural resources of Tasmania; and, in thanking you for these benefits, suffer us also to acknowledge one still more valuable than these, and still more worthy of our gratitude — that example, namely, which has testified among us the* *reality and the dignity of his calling who exchanges the ordinary pursuits and pleasures of life for the patient and self-denying investigation of the works of God: may He amply reward you with that knowledge for which you seek.*

" *Permit us, as your friends and well-wishers, bound to you more especially by the interest which you have attached to our adopted home, to offer our contribution towards the completion of your labours in illustration of the physical phenomena of this country. It was originally our purpose to have presented a chronometer as the token of our esteem, until we understood that you are already so well provided in that respect.*

" *We now beg to be allowed to leave to your better judgment the selection of a more appropriate alternative; feeling, at the same time, that the result of your labours, when given to the world, would form a most fitting and durable monument of your connection with those regions, and (we trust it may not be ungrateful to you to add) with the friends whom you have left behind.*"

The signatures to this address were headed by that of His Excellency the Governor, Sir John Franklin, R. N.; His Honour the Chief Justice, Sir John Pedder; the Colonial Secretary, G. Boyes, Esq.; and comprehended those of most of the settlers in Van Diemen's Land.

To the very flattering expressions and hearty good wishes which this address breathes throughout, was added a subscription amounting to 400*l.* sterling, 100*l.* of which was contributed by Sir John Franklin himself.

I need not say with what emotions of honest pride and pleasure I received this address and subscription, and how fully and gratefully I appreciated the extreme kindness with which I was honoured by the Tasmanian Public; but I may be permitted to state that this testimonial became mainly instrumental in determining me to venture on this present publication of "The Physical Description of New South Wales and Van Diemen's Land."

This "Description," comprehending the fruits of five years of continual labour, during a tour of 7000 miles, on foot, is divided into eight sections, or parts.

The *first* embraces the history and results of the Marine Surveys of Terra Australis, and the Land Surveys made of New South Wales and Van Diemen's Land, to which countries the work refers.

The *second* treats of Terrestrial Magnetism.

The *third* is devoted to Geology and Mineralogy, and furnishes the elements of illustration and reference for the succeeding sections.

The *fourth* treats of Climatology; the *fifth* of the fossil and existing Flora; and the *sixth* of the fossil and existing Fauna. In the first subdivision of each of the two last sections will be found the description, determination, and comparison of all the organic remains which afforded geological evidence as to the succession, analogy, or identity of the various formations.

The *seventh* contains notices on the physical, moral, and social state of the Aborigines, and the causes of their decrease.

And lastly, section *eight*, in glancing at the state of the Colonial Agriculture, exhibits what has already been done to turn to account the natural advantages of both countries; and points out what further resources are in store for the application of industry and capital on the part of the Colonists.

Whether the pages which follow, clothed, as they are, in a foreign and unidiomatic English, are worthy of being laid before the British public, will remain for the reader to decide. To the objections which may be raised to errors occurring in the course of the work, and which I cannot but myself perceive, I would merely reply, Go and do better; and you will see me greet your book with a joy far surpassing the pleasure which the writing of *this* has given to me.

I cannot refrain, on this occasion, from mentioning with grateful pleasure the ready aid and assistance which I have received, in all quarters of the globe, from the Officers of the Royal Navy; and who most hospitably received me in their ships, enabling me thus to visit many places which otherwise it would have scarcely been possible for me to have reached, and affording innumerable facilities for observation, which I could not otherwise have enjoyed. In particular, I must express myself in terms of grateful feeling to the Honourable Captain George Grey, for the warm and unwearing kindness I experienced from him during my stay on board Her Majesty's ship "Cleopatra," of nearly ten months, and this while that ship was visiting the Pacific coast of South America included between Chili and California; to Captain Russell Elliot, commanding Her Majesty's ship "Fly," and who afforded me the opportunity of visiting the Marquesas, Sandwich, and Friendly Islands; and, lastly, to Captain P. P. King, and Captain J. L. Stokes, for their steady friendship and their useful assistance during the whole of my travels and researches in Australia.

Not less great obligation do I owe to Sir Henry De la Bêche, and Dr. Fitton, for the kind interest and aid with which they promoted the publication of this work; and to Messrs. J. Morris and J. Lonsdale, for the valuable description which these two gentlemen furnished of the organic remains.

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⁂ All the figures have been carefully executed by Mr. J. de C. Sowerby, with the exception of those on Plates XII. and XIX., engraved by Mr. G. B. Sowerby, Jun.

PHYSICAL DESCRIPTION
OF
NEW SOUTH WALES,
&c.

SECTION I.

MARINE AND LAND SURVEYS.

INTRODUCTION.

"In 1788," says Lieutenant-Colonel Collins*, "on the evening of the 25th of January, Governor Phillips arrived in Port Jackson, and anchored off the mouth of the cove intended for the settlement. The spot chosen for this purpose was at the head of the cove, near a run of fresh water which stole silently through a very thick wood, the stillness of which had then, for the first time since the creation, been interrupted by the rude sound of the labourer's axe and the downfal of its ancient inhabitants; — a stillness and tranquillity which from that day were to give place to the noise of labour, the confusion of camps and towns, and the busy hum of its new possessors.

"* * * The whole of the party then present were assembled at the point where they had first landed, and on which a flag-staff had been purposely

---

* Collins's "Account of the English Colony of N. S. Wales."

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erected, and an union jack displayed; when the marines fired several volleys; between which the healths of his Majesty and the Royal family, with success to the new colony, were most cordially drunk. A portable canvas house, brought over for the governor, was erected on the east side of the cove, which was named Sydney. * * * Every person belonging to the settlement being landed, the numbers amounted to 1030 persons.

"As soon as the hurry and tumult necessarily attending the disembarkation had a little subsided, the governor caused his Majesty's commission, appointing him to be his Captain-General and Governor-in-chief, in and over the territory of New South Wales and its dependencies, to be publicly read, together with letters patent for establishing courts of civil and criminal judicature in the territory."

Such is the recorded account of the first settlement effected, in 1788, in Terra Australis.

In 1843, August 4th, we read in the "Australian," one of the Sydney papers*, as follows:

"Yesterday (August 3d) pursuant to the Governor's intimation to the Speaker, Mr. M'Leay, on the oc-

---

April, 1839.

* **Since my arrival in Sydney, I cannot cease asking myself, am I really in the capital of that "*Botany Bay*" which has been represented as "*The Community of Felons,*" as "*the most demoralised colony known in the history of nations,*" as "*a possession which adds a tarnish rather than a lustre to the British Crown,*" &c. &c.**

Let the authors of these and other epithets contained in the numerous works which they wrote on New South Wales congratulate and applaud themselves: my mystification was complete. The evening I effected my disembarkation in Sydney, I did it with all imaginable precaution, leaving my watch and purse behind me, and arming myself with a stick; being resolved to encounter inevitable and imminent dangers with the least possible risk!! * * *

I found, however, on that night, in the streets of Sydney, a decency and a quiet which I have never witnessed in any other of the ports of the United Kingdom. No drunkenness, no sailors' quarrels, no appearances of prostitution, were to be seen. George Street, the Regent Street of Sydney, displayed houses and shops modelled after the

casion of his presentation, his Excellency, Sir George Gipps, proceeded to the Council Chamber, for the purpose of opening the session, and declaring the purposes for which he had summoned the members. At an early hour the house presented an animated and brilliant appearance; most of the seats in the body of the chamber being filled with elegantly-dressed ladies, amongst whom we noticed Lady Gipps, Lady O'Connell, Mrs. Deas Thomson, Mrs. George M'Leay, Mrs. C. M. O'Connell, and the female part of most of the families of the members of council and their friends. A guard of honour was drawn up in

fashion of those in London; but nowhere did its lamps and the numerous lights in its windows, which reflected upon the crowd, betray any of those signs of a corrupt state of society common to the streets of other capitals. Since then how many nights like the first did I not witness, in which the silence, the feeling of perfect security, and the delicious freshness of the air, mingled with nothing that could break the charm of a solitary walk! At ten o'clock all the streets are deserted: to the bustling industry of the day succeeds a happy repose; and to that again a day of fresh struggles, successes, or failures! Extraordinary race! the only people who — to speak the language of one's own craft — seem subjected to atomic laws, immutable and independent of the varieties of climate; aggregating by a kind of molecular attraction, constantly in the same order; and expanding, however dispersed, into a similar social structure, thus everywhere preserving those properties and tendencies which nature assigns to their primitive form.

Other races, like true children of the soil, identify themselves with it, draw from it their sustenance, their power, and their nationality; call it country; love and cherish it as such, and cling to its bosom, though at the cost of freedom, of comfort, of property, and even of life. Banished from it, they become but lost wanderers, and soon degenerate; like the alpine rose, which when transplanted even to more genial regions loses its blossoms, and sends forth only thorns.

The hardy nature of the Anglo-Saxon race is proof against the effects of transplantation: for it does not depend on the soil either for its character or its nationality: the Anglo-Saxon reproduces his country wherever he hoists his country's flag.

The United Kingdom is far from furnishing a just idea of this race. The traveller there is like one buried in the entrails of a colossus. It is in the United States, in the West Indies, in the factories of South America and China, in the East Indies, and in this town of Sydney, that the prodigious expansion of the Anglo-Saxon life, the gigantic dimensions of its stature and the energy of its functions, are fully perceived and appreciated. — *MS. Journal of the Author.*

the court-yard of the chamber, and his Excellency was received with presented arms, the band playing 'God save the Queen.'

"The Governor was received at the door of the council chamber by the Speaker, who conducted him to the vice-regal chair prepared for him on the *left* of the Speaker's chair. At this moment the appearance of the house was extremely striking; the elegant costumes of the ladies, and the brilliant uniforms of the official and military members, and of the numerous staff, which occupied places below the vice-regal chair, completing the *mise en scene*, which was in every respect worthy of the occasion. The mayor, aldermen, and common council of the city were accommodated with seats within the bar. The strangers' gallery was crowded to excess, as was also the reporters' gallery — of which, however, we should be ungrateful to complain, inasmuch as every desire has been evinced by Mr. Lewis and the other authorities to meet the views and adopt the suggestions of the respective journals. Reverting to the brilliant appearance of the chamber, we must not omit to notice the prompt adoption of our hint by Mr. W. C. Wentworth, who, on this occasion, appeared in the usual costume of the time — a mark of good sense that we gladly recognise.

"His Excellency having taken his seat, delivered the following address: —

"Gentlemen of the Legislative Council.

"The time has at length arrived which has, for many years, been anxiously looked forward to by us all; and I have this day the pleasure to meet, for the first time, the Legislative Council of New South Wales, enlarged as it has been under the statute recently passed by the Imperial Parliament for the government of the colony. I congratulate you very sincerely on the introduction of popular representation into our constitution, and I heartily welcome to this chamber the first representatives of the people.

" The period, gentlemen, at which you enter on your functions, is one of acknowledged difficulty, and it is therefore more grateful to me to have my own labours and responsibilities lightened by your co-operation and assistance.

" I shall most readily concur with you in any measures which may be calculated to develope the resources of the colony, by calling into action the energies of the people, taking care, however, that we proceed on sure principles, and not overlooking the great truths, that the enterprise of individuals is ever most active, when left as far as possible unshackled by legislative enactment, and that industry and economy are the only sure foundations of wealth. Great as undoubtedly are the embarrassments under which numbers, even of the most respectable, of our fellow-subjects in the colony are now labouring, it is consolatory to me to think, that grievous though they be to individuals, they are not of a nature permanently to injure us as a community; that, on the contrary, they may be looked on as forming one of those alterations in the progress of human events, which occur in all countries, and perhaps most frequently in those whose general prosperity is the greatest.

" Nor should we, gentlemen, enter upon the labours of this session, without making our grateful acknowledgments to Almighty God, for the many blessings he has showered down upon us. Our embarrassments may be the effect of our own errors — but it is to His bounty and goodness we are indebted, that the fruits of the earth, as well as the productions of industry, abound throughout the land. If, in addition to the monetary confusion which has grown out of our excessive speculations, it had pleased the Almighty further to chastise us with drought or scarcity, the condition of New South Wales, and more particularly that of the labouring classes of its population, might have been lamentable indeed. As it is I do not doubt that, by frugality and prudence, we may overcome all our difficulties; and, I am happy to say, there is nothing in what more immediately concerns the government, to lessen in any degree the confidence which I feel in the stability of the country. Cheapness and plenty cannot be permanent impediments to the advancement of any community.

"I shall immediately cause to be laid before you numerous public documents of much importance, and some projects for amendment in the law. Amongst these latter will be the draft of an Act for the establishment of a General Registry, and of one to regulate the office of sheriff. I shall also have to direct your attention to the state of the law under which the Savings' Bank of the colony is established: the propriety will, I think, be readily admitted of placing the credit of this most useful institution beyond the reach of doubt.

"I shall speedily cause the Estimates for the year 1844 to be brought under your consideration, and take advantage of that occasion to make a clear exposition of the financial state of the colony.

"The despatch from the Secretary of State, No. 181, of the 5th September, 1842, is a document of such importance, that I think it ought to appear on the record of your proceedings, and accordingly I shall lay it before you, notwithstanding it has been already printed by order of the late council.

"In this despatch, the views are explained of Her Majesty's government in respect to the Act of Parliament under the provisions of which I now meet you for the first time in this chamber.

" The benevolent intentions of Her Majesty, her Majesty's advisers, and of the British Parliament, are so well set forth in the words of the noble Secretary of State, that I feel I should only weaken the effect they are calculated to produce upon you, were I at any length to comment on them, or make to them additions of my own. I cannot, however, gentlemen, on this my first occasion of addressing you, avoid adverting to the peculiar constitution which has been given to your body — or to the fact, that to you singly have been confided by the Imperial Parliament the powers, which in some of the older colonies of Great Britain are divided between two separate bodies.

" The council, gentlemen, is composed of three elements, or three different classes of persons — the representatives of the people — the official servants of Her Majesty, and of gentlemen of independence — the unofficial nominees of the Crown.

" Let it not be said or supposed that these three classes of persons have, or ought to have, separate interests to support — still less that they have opposing interests, or any interest whatever, save that of the public good. Let there be no rivalry between them, save which shall in courtesy excel the other, and which of them devote itself most heartily to the service of their common country.

" His Excellency then retired."

The fifty-five years which fill the space between the two above noticed extraordinary and strikingly contrasting eras, 1788 and 1843 — a period unparalleled in the records of any colony — have been marked on the part of the colonists by many severe trials, continual struggles, extensive improvements, and that praiseworthy perseverance in developing the resources of the country, and in raising themselves in the social and commercial scale, which have at last won the colony its richly deserved Representative government.

In a political point of view, the history of this intermediate epoch is replete with facts of the deepest interest to the philosopher and the statesman; affording, in many instances, an insight into the curious processes attending the elaboration of social schemes, and corroborating in others, what has been long ago proved to be the case, viz. that the most captivating theories are not always the most practicable and successful, and that a measure the least dependent on theories, but which results from, and is subservient to, the actual exigencies of society, never fails to promote its welfare.

Thus the system of transportation, which was denounced by European politicians and moralists, as fraught with mischief and ruin to society, because inconsistent with their theories and maxims of criminal legislation and political morality, has succeeded to a certainty as well ascertained as any circumstance may be by human experience; and has succeeded in spite of bitter invective, plausible reasoning, unmeasured censure; and, strange to say, through the very means which theory pointed out as having a most dangerous tendency, namely, the encouraging of free men to emigrate into a penal colony, and the encouraging of those in bond to industry and to the acquisition of property.

To enter at large into the benefits of transportation combined with free emigration; to point out the calumnies and wilful misrepresentations, or the unintentional, but not less flagrant misconceptions to which this question has exposed New South Wales and Van Diemen's Land; to attempt to remove the ridiculous prejudices, or the mistaken impressions, of the mother country in respect to the true state of these colonies; and, lastly, to render justice to the colonists themselves for the steady deportment and the unwearying efforts they have so courageously displayed throughout their colonial career, would be to enter on subjects quite foreign to the physical description of the two countries.

The origin of the colonies has been touched upon, because that origin is to be ascribed to the hydrographical knowledge which the government of the mother country possessed regarding the capabilities of the eastern coast of New Holland: some of the events, also, connected with the progress of the colony have been just adverted to, because the importance they have assumed in respect to commerce and industry has operated most powerfully and beneficially in causing a completion of surveys by sea and land, the history of which is now laid before the reader.

MARINE SURVEYS.

The first page of this history commences with the voyage of Captain Cook. With those anterior to his, whether undertaken by Portuguese, Spanish, or Dutch navigators, science has little to do. They were all jealous and avaricious, and kept their discoveries secret, seeking, and some of them indeed finding, their reward in self-aggrandisement: thus leaving behind names which only perpetuate their own or their country's illiberality.

Cook also transmitted his name to posterity, but it was by virtue of the benefits he conferred upon the aborigines of the different islands which he visited, and by those also which his voyages, through the medium of the press, secured to geography, natural history, navigation, and commerce. With him may be said to have dawned the first glimpses of positive knowledge which the civilised world obtained regarding the existence of Terra Australis; and with him also commenced that series of maritime surveys which, followed up by Flinders and King, give to Great Britain the most legitimate title to the sovereignty of New Holland and Van Diemen's Land.

It was during his first voyage, in April 1770, that Cook, on leaving New Zealand, discovered, in the neighbourhood of Cape Howe, the eastern shore of New Holland. The place which he at first anchored at, the Botany Bay of our times, may be thus looked upon as the commencing point of his survey. From Botany Bay he proceeded to the northward. In the neighbourhood of Cape Tribulation, his ship struck on a coral reef; which accident threatened to be as fatal as the subsequent escape from its consequences appears wonderful. The vessel having been repaired at Endeavour river, resumed its voyage of discovery. Keeping along the shore, the expedition reached a point of land from which appeared an open sea to the westward, and passed through the strait between New Holland and New Guinea, the existence of which, although long ago discovered, had been partially kept a secret, and was considered by Cook himself as very doubtful. At Cape York, from whence the distinguished voyager directed his course to Java, terminated his cursory examination of that part of the east coast of New Holland which lies north of Botany Bay. Southward of that locality, nothing was known beyond what, in the second voyage of Captain Cook, Captain Furneaux, tracing the southern and a part of the eastern coast of Van Diemen's Land, reported, namely, "that there is no strait between New Holland and Van Diemen's Land, but a very deep bay!"

To the south-west and west, several points of the coast had been seen at different periods by occasional and transient navigators. Of the partial contributions which thus accrued to hydrography, none are more worthy of record than those of the French expedition in 1792, which, while sailing under Admiral d'Entrecasteaux, in search of the unfortunate "La Perouse," favoured the scientific world with a published survey of the coast line from Cape Lecuwin to Long. 132° in New Holland, and of the south extremity of Van Diemen's Land, including the river Derwent and the channel which bears d'Entrecasteaux's name.

"The charts of the last survey, particularly those relating to the bays, ports, and arms of the sea of the south-east of Van Diemen's Land, and constructed in this expedition by M. Beautemps Beaupré and his assistants, appear to combine scientific accuracy and minuteness of detail with an uncommon degree of neatness in the execution. They contain some of the finest specimens of marine surveying perhaps ever made in a new country."—(*Flinders.*) The knowledge of the form and outline of this still mysterious continent, as derived from these occasional surveys, or from the rumours which naturally arose through the obstinate secrecy of the Portuguese, Spaniards, and Dutch, amounted pretty nearly to this:—that Terra Australis is composed of two large continents, of which the more easterly included Van Diemen's Land, and which were divided by a wide channel running from north to south, the Gulf of Carpenteria being considered the northern extremity of that channel, and the great Australian bight, the southerly one.

Such was the sum of geographical information or rather misinformation respecting this section of the world prior to 1797, when in that year, Midshipman Flinders, and Mr. Bass, surgeon in his Majesty's navy, visitors to the then already flourishing colony of Port Jackson, undertook a series of expeditions which not only led to a discovery of the straits between New Holland and Van Diemen's Land, but of various harbours and rivers in the two countries.

Their first attempt to penetrate to the southward of Port Jackson was made in a boat, eight feet long, called the "Tom Thumb," and of which they themselves and one boy formed the entire crew. Attended with more dangers and providential escapes than advantages, this adventurous expedition was but the forerunner of a bolder and more successful enterprise. In the beginning of 1789, Mr. Bass ventured in a whale boat along a coast line of 300 miles; and reached and discovered the straits since named after him, and Port Western, while Mr. Flinders on his side visited in a small, leaky, and unseaworthy craft, the land seen by Furneaux, and discovered the chain of islands between Cape Portland and Wilson's promontory. About the end of the same year, both the voyagers embarked in the "Norfolk," a schooner of twenty-five tons, and discovered Port Dalrymple, the river Tamar, the inlets and bays of the river Derwent, and Tasman's peninsula, and succeeded in circumnavigating Van Diemen's Land, thus completely establishing the fact of its insularity.

The perusal of the details relating to these discoveries, which are here only summarily noticed, cannot but excite in every one acquainted with the boisterous climate of the region in which they were made, and with the slender means by which they were achieved, sentiments of unmingled respect and admiration for the memory of the enterprising voyagers. Indeed to both of them may be applied the eulogium which, in his work, Captain Flinders passed on the labours of his departed friend Mr. Bass: "The public will award to the high-spirited and able conductors of these voyages — alas! no more! — an honourable place in the list of those whose ardour stands most conspicuous for the promotion of useful knowledge." *

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* No public act or expression of opinion has as yet occurred which can be viewed as a fulfilment of this anticipation; but the more genuine

The charts, dated 1801, which were the result of the joint and separate expeditions of Messrs. Flinders and Bass, gave a delineation and a survey of the line of coast from Port Jackson to Western Port, of the islands of the straits, and of Van Diemen's Land, including the survey of the river Tamar, and the bays and coves of the river Derwent and Tasman's Peninsula. They combined with nautical information accounts of the productions and capabilities of the discovered and examined harbours, and were considered of such signal service to science, commerce, and colo-

and disinterested impulses of private feeling have already led a brother officer to pay an interesting tribute to the memory of Flinders.

Out of his own purse, and at a cost of more than 250*l.*, His Excellency Sir John Franklin, late Governor of Van Diemen's Land, has, within the last year, caused to be erected on the peak of Stamford Hill, near Port Lincoln, a lofty stone obelisk, whereon is fixed a tablet bearing the following inscription, the kind and manly English feeling discoverable in which does honour alike to him to whom the monument is raised and to him who raised it.

THIS PLACE,
FROM WHICH THE GULF AND ITS
SHORES WERE FIRST SURVEYED
ON 26TH FEBY. 1802, BY
MATTHEW FLINDERS, R.N.,
COMMANDER OF H. M. S. INVESTIGATOR,
AND THE DISCOVERER OF THE COUNTRY
NOW CALLED SOUTH AUSTRALIA,
WAS
ON 12. JAN. 1841,
WITH THE SANCTION OF
LT. COL. GAWLER, K. H.
THEN GOVERNOR OF THE COLONY, SET APART FOR
AND IN THE FIRST YEAR OF THE
GOVERNMENT OF CAPTAIN G. GREY
ADORNED WITH THIS MONUMENT
TO THE PERPETUAL MEMORY
OF THE ILLUSTRIOUS NAVIGATOR,
HIS HONORED COMMANDER,
BY
JOHN FRANKLIN, CAPTAIN R. N.
K. C. H. R. R.
LT. GOVERNOR OF
VAN DIEMEN'S LAND.

nisation, that no sooner had Mr. Flinders reached England, and made them known to the government, than he was promoted to the rank of lieutenant, and very shortly after, to that of commander, with a commission to the "Investigator," a sloop of war fitted out for the purpose of a complete examination and survey of New Holland and Van Diemen's Land."

The instructions which, on that occasion, Captain Flinders received from the Admiralty embraced a wide range of nautical and other scientific inquiry. The choice of instruments, books, officers, and scientific men was liberal and judicious. In the list of the latter appear the names of John Franklin and Robert Brown; names which, since that period, have been seen constantly connected with services rendered to science. The expedition was moreover secured against all chances of war, by a passport from the French Government, which, on principles worthy of the enlightened age, granted to it protection, assistance, and free ingress and egress to and from the ports of the French Republic.

In December, 1801, the expedition reached Cape Leeuwin. The line of coast stretching eastward of that cape to 130° of E. longitude had been, as already said, surveyed by the French under Admiral d'Entrecasteaux; but Captain Flinders, following the same track with the French chart in his hand, could not but improve upon that chart, partly in the details of many indentations of the coast, partly in soundings, in which the chart constructed by M. Beautemps Beaupré, geographical engineer on board the "Recherche," was particularly deficient. This re-examination of the French survey, besides securing the soundings, led to the fuller examination of King George's Sound, the archipelago of the "Recherche," by which Lucky Bay, and many other coves or places of shelter, were discovered. Arrived at longitude

130°, at which point the French survey ceased, the examination of the unknown coast was commenced with all the interest and excitement which the exploring of a new region imparts. Such was the mystery in which the actual form of Terra Australis was at that time still enveloped, and so great was the tendency to imagine it divided by a sea channel running from north to south, that when the expedition anchored in the evening at the south-eastern extremity of Thistle Island, and its coast was observed trending away to the northward until all signs of land disappeared in that direction, while at the same time no sensible tides were noted, numerous anticipations and conjectures were raised as to the probable existence of deep inlets, inland seas, and passages into the Gulf of Carpenteria, and prospects of finding large rivers flowing into them, with other still more interesting discoveries, were freely indulged in.

If, on the next morning and the following days, the further examination of the coast dispelled some of these expectations, it realised others, in the discovery of Spencer Gulf, Kangaroo Island, and Port Lincoln, which last has since become a prosperous outlet for commerce.

While engaged in the survey of the main coast eastward of Cape Spencer and of Cape Jarvis, the expedition met the "Geographe," a French ship, engaged also in a voyage of discovery, and commanded by M. Baudin. The situation of both the ships at the moment when they hove-to for the purpose of communicating, was, as determined by Captain Flinders, 35° 40′ south latitude, and 138° 58′ east longitude. Considering that the nations to which the ships respectively belonged were at that period at war, and that their respective flags, whenever brought in sight of each other, became the signal of a fierce and bloody struggle, we cannot too highly estimate the advantages of civilisation when we find that, on this occasion, the display of the national colours of the "Investigator" and the "Geographe" aroused only sentiments of respect and regard for the interests of science.

Both the commanders met on board the "Geographe," in presence of Mr. R. Brown; exchanged freely and most liberally all the information which they thought would be most serviceable to each other, and parted on the 8th of April, 1802, Captain Baudin directing his course to the north west, Captain Flinders to the southward.

Before entering the straits, Captain Flinders made a running survey of the coast discovered by the French, and marked on the chart as Capes Bernouilly, Jaffa, and Buffon. Grant's discoveries, viz. King's Island, Cape Otway, Port Phillip, and Cape Shank, were next verified, as also the points marked in the previous survey of Bass and Flinders in Bass's Straits.

On the 9th of May, 1802, the "Investigator" entered Port Jackson, to refit for the prosecution of further surveys.

In July of the same year, she sailed for the northward of Sydney, and skirting the line of coast between Port Jackson and Glass-house Bay, began the examination of the north-east coast at Breaksea Spit. The survey of the Great Barrier Reef, which from that parallel stretches along the coast to the northward, was together with many indentations of the coast itself, replete with as much interest as danger. The examination of Harvey's Bay, Bastard Bay, Port Curtis, Keppel Bay, Port Bowen, and Broad Sound, also furnished many valuable observations connected with science and with the capabilities of the country. The main object, however, of the expedition being to reach the Gulf of Carpentaria before the north-westerly monsoon set in, Captain Flinders deferred to a more suitable season the farther examination of the easterly coast, and eagerly set about seeking a passage through the Great Barrier Reef, in order to take the outer route to Torres Straits, and ensure, as he thought, a safe and speedy voyage. After leaving Sandy Spit, this Barrier presented an uninterrupted wall exceeding 100 miles in length. Abreast, however, of Cape Cleveland, it was broken by a narrow channel, of which advantage was taken; the expedition passed through, cleared Torres Straits the close of October, and began, with the 1st of November, the survey of the east side of the Gulf of Carpentaria.

The shallowness of the water made it impracticable to keep close to the shore, and allowed only occasionally an approach to or landing upon it. The examination, therefore, of such features of the coast as are recorded in the course of the voyage, was mostly made at three or four miles distance. To the objects, however, of a survey, this was unimportant, as the 450 miles of coast were so low that the highest elevation, which was observed at Sweer Island, did not much exceed that of the ship's mast-head.

About this locality, the progress of the expedition was interrupted by damages discovered in the ship, and which proved to be of a nature calculated to deject and discourage the spirit of the most undaunted voyagers. Her timbers had become so rotten that she could not bear heaving down, and it was found that laying her on shore for the purpose of repair would only endanger her farther. This unfortunate situation, so entirely beyond the reach of remedy, was rendered worse by the presence of a monsoon unfavourable for a return to Port Jackson *viâ* Torres Straits; and considering that the expedition was at that time at the height of its labours and its expectations, and had arrived at them through many toils, dangers, and anxieties, one cannot wonder, that when it was reported that the "Investigator" was "incapable of encountering bad weather, and, even if constant fine weather could be secured, and all accidents avoided, was incapable of running more than six months," Captain Flinders should feel his surprise and sorrow beyond the "power of expression."

The westerly route, being the only one left for her return, was, with all the chances of a boisterous sea off the western and southern coast, instantly decided on; and the more readily, as this course offered a prospect of completing at least the examination of the Gulf of Carpentaria.

Hitherto, Captain Flinders, animated by a strong desire to unite to a determining of the general outline or exterior form of Terra Australis, all those interesting and valuable details regarding its coast, which might lead to the discovery of some interior inland communications, fearlessly approached the shores and explored bays and rivers, whenever the soundings or wind allowed. During the remainder of the expedition, however, the idea that the "Investigator," "getting on shore under any unfavourable circumstances, would go to pieces," predominated, and the object of the survey became secondary to the safety of the ship's company.

The natives too, who until now had not molested the expedition, began to offer opposition whenever landings were made for effecting astronomical observations, or conducting researches connected with natural history and botany. Indeed their character, as compared with that of the natives of the south coast, or even with that of those of Torres Straits, who were seen to approach the vessel freely for the sake of barter, exhibited very unfavourable traits;

their conduct being marked by distrust, hostility, and not a small share of that cunning which inspires confidence and profits by credulity. Along the whole length of the western side of the Gulf of Carpentaria, and on the islands which lay here and there opposite the mainland, the expedition had, when wooding and watering, to be constantly on their guard against attacks and ambushes, especially at Wellesley's Islands, Sir Edward Pellew's, Gray's, and Grote Island, and at Blue Mud Bay, where they had to deplore the loss of two men.

The coast also, of which the fore-ground consisted of mud flats or mangrove trees, and the back-ground of equally low land, presented a tedious and monotonous uniformity of aspect that was far from diverting the anxieties or cheering the drooping spirits which the state of the ship and the inhospitality of the inhabitants had not failed to produce.

With Arnhem Cape, where Captain Flinders terminates the examination of the Gulf of Carpentaria, — an examination which, exclusive of the numerous islands and openings, embraced a tract of little less than 400 leagues in length, — with that cape may be said to conclude the record of all his labours and surveys in Terra Australis, and to begin that which relates only to his disappointments and misfortunes.

Indeed his return to Sydney, amid dangers and difficulties arising from the state of the ship, and the sickliness of the crew; his departure in the "Porpoise;" his wreck on Cato's Bank; his being driven in the "Cumberland" by distress to the Mauritius; and his unwarrantable detention during eight years, in spite of passports and remonstrances, by General de Caen, include a history of moral and bodily sufferings, which nothing but an energetic character and a not less vigorous constitution could have sustained. His work, with an atlas, published soon after his return to England, while bearing evidence of both these qualities, which so eminently distinguished Captain Flinders, displays also uncommon ability and talent for observation; and for the minuteness of details and the mass of valuable information it conveys, may be ranked amongst the most important contributions ever made to general knowledge, and towards promoting the interests of colonisation.

Contemporaneously with the expedition of Captain Flinders (1801), that of the French under Captain Baudin appeared on the south-east coast of Van Diemen's Land. Their discoveries on the southern coast of New Holland are included between 37° 36′ and 35° 40′ of south latitude, and 140° 10′ and 138° 58′ longitude east of Greenwich, — a coast-line of about 50 leagues in length, devoid of rivers, inlets, or place of shelter.

In its further progress to the N. W., the line of coast from Cape Leeuwin to Rottnest Island, and including Swan River, was examined by the expedition, and correctly laid down on the chart. The survey S. W. of Cape Londonderry came next; but, with the exception of Cassini Island, it does not possess the merit of the preceding survey, as the coast was passed at too great a distance to allow of correctly laying down the numerous islands which front it, and the details in the configuration of the mainland. To the southward of Melville Island, many points of the coast and of the islands fringing it were discovered, and their position accurately ascertained.

After the terminations of Flinders's and Baudin's expeditions, an interval of twelve years succeeded, during which neither the English nor the French were in a position to divert their attention from the field of war to that of geographical discovery. The peace, however, of 1815, which was productive of so many political and social advantages, gave a fresh stimulus to the suppressed and confined energies of

England. Amongst her naval officers particularly, the recollection of former glory, earned in the field of discovery, acted as an incitement to new attempts and adventures. With some, indeed, the military spirit seemed entirely subordinate to the attractions of scientific enterprise; and it was then that the English government, fully impressed with all the advantages likely to accrue, promoted those expeditions of Ross, Parry, Franklin, Owen, and King, which in point of extent, importance, difficulty, danger, variety, and the skill with which they were conducted, stand unparalleled in the history of voyages.

On the last of the above-named officers devolved the important task of completing the Australian survey, which, as stated before, was interrupted by the unfortunate circumstance of Captain Flinders' detention.

The instructions given to Captain P. P. King directed the examination of the eastern coast, from the Tropic to Cape York; the survey of the hitherto unexplored shores from Arnhem Bay, near the western entrance of the Gulf of Carpentaria, westward and southward as far as North West Cape, including the Gulf of Van Diemen's Land and the cluster of islands called Rosemary Islands, together with the inlets behind them; and also the examination of the western coast between North West Cape and Cape Leeuwin; forming, in all, a line of coast amounting to 4000 miles.

The importance which the English government attached to this mission caused Captain King to lose no time in proceeding to the scene of his labours. He was appointed in February, 1817, and in the following September he arrived at Sydney; purchased and completed the outfit of a colonial vessel, the "Mermaid," eighty-four tons; and reached North West Cape on the 1st of January, 1818.

Commencing with the examination of Exmouth Gulf, the survey embraced in its course the entire line of coast extending to Deputch Island, with the group of islands which front it. The name of Dampier's Archipelago, given to that group by the French, was admitted by the expedition, with the difference only of its being extended to the islands forming the east side of "Mermaid's Straits," which islands are laid down on the French chart as part of the mainland. The whole coast was found composed of very low shores bordered either by "dunes," or by impervious forests of mangrove trees, beyond which no part of the interior could be seen.

With the natives, both on the mainland and on the small islands fronting it, every means was resorted to for establishing a friendly intercourse. One of them even, while passing from one island to another on a catamaran, formed of two mangrove logs lashed together, and on which he sat astride and paddling with his hands, was intercepted, brought on board, caressed, fed, and sent back to his alarmed friends with presents; but all these attempts proved of no avail, as, with but few exceptions, wherever a necessity for landing occurred, the unfriendly disposition of the natives led them either to oppose it, or to molest the whites when it was effected.

The expedition next determined the position of the long shoal called Rowley Shoal, a dangerous reef in the open sea about 120 miles from the coast; and as the easterly monsoon was at hand, it then sailed to the northward, in order to resume the survey at Cape Arnhem, at which point Flinders' survey ceased. Contrary winds, however, only allowed the vessel to reach that part of the coast called Point Braithwaite, from whence it was, that, in proceeding to examine the coast to the westward, Captain King discovered Port Essington, — an important discovery, as its situation not only connects it with the commercial interests of the opposite islands and settlements, but, in case of war, enables it to protect the passage through Torres Straits.*

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* In the address on the anniversary meeting of the Royal Geographical Society, the distinguished President of that Society, Roderick Impey Murchison, Esq., said, in reference to the importance of Port Essington: —

"If we are to confide in the clear and decisive testimony of Sir Gordon Bremer and other naval officers, including Captain Sir Everard Home, as well as in that of Mr. Earl and Captain M'Arthur, who have thoroughly examined the regions around it, we should be led to think that in all her schemes of future commerce, Great Britain has rarely had it in her power to place her standard on a more desirable spot than Port Essington. With an outer harbour capable of containing the whole British navy, and an inner harbour in which twenty-five sail of the line can lie at ease; with a climate peculiarly healthy to Europeans; in which spices, indigo, sugar-canes, the cotton, and the choicest woods, can be grown in abundance, whilst the sea swarms with the finest fish; this port further offers the great advantage of having a quiet and industrious race of inhabitants in the adjacent islands, who, as well as the more active inhabitants of Timor and the neighbouring isles, and also the Chinese, are ready to flock to the settlement. I am, indeed, led to believe, that no sooner shall our government render Port Essington a permanent and independent colony of the Crown, than several rich mercantile houses in London will at once set up establishments there, and freight large vessels for the trade which they would carry on, through it, with the Eastern Archipelago and China. Already many of the enterprising Malays resort thither for the fisheries, and are ready to exchange their salted fish and other products for British cottons; and as an entrepôt, it is daily becoming more important, from the rapidly increasing intercourse between our Australian and Indian possessions. Grand as is the future prospect of intercourse with India, the Eastern Islands, and China, Port Essington is not, however, to be viewed merely in reference to commerce. As a place of refuge in a wide ocean, it has a strong claim upon our nation, and it has already, even in its infant state, been the means of saving the lives of crews who had taken to their boats even as far off as Torres Straits. In this respect, indeed, a more intimate acquaintance with the Gulf of Carpentaria and Torres Straits, so dangerous from the adjacent coral reefs to ships which try that passage, may lead to the discovery of an additional harbour in its vicinity. But independently of this consideration, Port Essington ought to be viewed as a most advantageous naval station for Great Britain in case of war; and with the extension of steam navigation, it is further to be regarded as the point by which, in all probability, our future correspondence with our South Australian colonies might be most expeditiously and beneficially carried on."

The landing on the northern coast was as much interfered with by the hostility of the natives as that on the western; and on one occasion, when the boat with the principal officers of the expedition was entangled amongst mangroves, this hostility very nearly proved fatal to them, as the concealed natives assaulted them with clubs, spears, and stones: notwithstanding the danger which thus attended the landings, they were persevered in, whenever the interests of the survey and of science required it.

Shortly after the survey of Port Essington was completed, the expedition was forced to return to Port Jackson, owing to the injuries sustained by the vessel, the loss of anchors, and the sickly state of the ship's company.

Their stay in Port Jackson was short, as the anxiety of Captain King to lose no time expedited every necessary arrangement in the outfit. So great, indeed, was the solicitude he evinced for the interests entrusted to his care, that, having some time to spare before the monsoon would allow him to proceed by way of Torres Straits in order to resume his labours, he sailed for Van Diemen's Land, for the purpose of surveying and exploring Macquarie Harbour, and verifying some other positions on its southern coast.

This being accomplished, the expedition returned to Port Jackson, and, immediately after, sailed to the northward and surveyed Port Macquarie, the River Hastings, and Rodd's Bay; re-examining also the position of parts of the great Barrier Reef, and of the numerous bays and inlets of the eastern coast which front it, and which were embraced in the previous survey of the "Investigator." Where that survey ceased, the survey of Captain King began; and in its course finally led him to the important discovery of the inner route for vessels bound through Torres Straits, and which, in point of easy, safe, and speedy sailing possesses incontestable advantages over that called the outer route.

After rounding Cape York, and passing the Gulf of Carpentaria, the survey of the N.W. coast was resumed at Cape Wessel: in the course of a month it was carried out so as to connect itself with that of the last year; and on comparing the relative meridional distances ascertained in the two surveys, the difference was found to amount only to 1′ 2″, — an instance of the accuracy of the nautical observations, and the goodness of the chronometer, as gratifying to every lover of exact science as it must have been to Captain King.

Passing Melville and Bathurst Islands, the examination, omitted the previous year, of the coast to the S.W. of Vernon Island was continued. On arriving at Cape Londonderry, the expedition found that the plan of the islands which face it, as given by the French, was, with the exception of Cassini Islands, so defective that many of them could not be recognised. In the space embraced between Cape Bougainville and Cape Voltaire, and which was named Admiralty Gulf, Captain King fixed the position of at least forty islands and inlets.

The leaky state of the vessel, with loss of anchors and want of provisions, compelled the expedition to return to Sydney, which was reached on the 12th January, 1820. On the 21st of June, the repair and refitting being completed, the "Mermaid" sailed on her third voyage, being her second through Torres Straits, and resumed the survey with the coast S. W. of Cape Londonderry, from which, as before said, the French kept at a distance, and were thus prevented not only from noticing the minuter but even some of the main features of the coast. The survey of Montague Sound, York Sound, Prince Frederick Harbour, and the Hunter and Roe River followed; and there is no doubt that the greater part of the unsurveyed coast laying between Cassini and Deputch Islands would have been also duly examined, had it not been for the leak which the cutter had sprung, the necessary repair of which delayed the expedition at Careening Bay, and ultimately forced it back to Port Jackson.

On her arrival at Sydney in December, 1820, the cutter was condemned, and another vessel being provided, the expedition sailed in May on its fourth voyage, and, passing for the third time through Torres Straits, resumed and completed the survey of the coast-line between Careening Bay and Cape St. Eveque, including its bays, inlets, and rivers, and Buccaneer's Archipelago.

In Hanover Bay, the expedition tried again, by presents and kindness, to conciliate the natives, but on this occasion they showed their inimical disposition more than upon any, as, on the party's turning their backs to regain their boats, the surgeon of the expedition, Mr. Hunter, was dangerously wounded with a spear.

The fatigue of wooding and watering, and the constant harassing employment attendant on the survey of this part of the coast, produced bilious fever attacks amongst the crew, which, together with the dry provisions, much spoilt by rats and cockroaches, and the loss of two anchors, obliged the expedition to seek assistance at the Mauritius. Accordingly, it left the coast in September, and returned to it from Port Louis in December. The examination of the coast from Cape Leeuwin to Rottney Island, which followed, proved that a portion of it was correctly laid down by the French; but as the outline of that part to the northward of Rottney Island, as given in their charts, was chiefly taken from Van Keulan, Captain King made a survey of it, and continued the same to Dirk Hartog's road. The examination of the coast of the north-west cape came next, which proved the position of the cape to be 10° southward of that assigned to it by the French, while neither Hermit Island nor the land laid down on their charts as being westward of Trimouille Island was to be seen.

The expedition likewise revisited and verified the position of Barrow Island, Montebello Island, Rowley's Shoals, Cape l'Eveque, and Buccaneer's Archipelago, and terminated its labours by the examination of Cygnet Bay. In April it anchored off Sydney, after 344 days of absence, and in the same year returned to England.

The results of this four years' labour may be given in the following summary: —

1st. A running survey was made of that portion of the east coast which is situated between Perry Island and Cape York, a distance of 900 miles, and which, being laid down for the first time, became a valuable and convenient track for vessels bound through Torres Straits.

2ndly. The examination was effected of the N. and N. W. coast from Cape Wessel to Cape Villaret, including Port Essington, — a distance of 1100 miles.

3rdly. Of the coast between Deputch Island and Cape Leeuwin, a distance of 700 miles.

This makes a total of 2700 miles of surveyed coast; besides Macquarie Harbour, Port Macquarie, and Rowley's Shoals, &c. Those who have not been professionally employed in similar undertakings can scarcely conceive the amount of labour which is involved in a survey of 2700 miles; neither could any description give them the remotest idea of the difficulties, the trying situations, and the anxiety, which the commanding officer in such a survey has to encounter. Personal peril and the inconveniences arising from cold, heat, wet, fatigue, and frequent want of food, are sufferings which a man passionately fond of his profession, and ardently devoted to his enterprise, little cares for; they are indeed trifling in comparison with those bitter disappointments and harassing anxieties which unfavourable weather, adverse winds, the wear and tear of the vessel, the loss of boats, anchors, and instruments, produce, or which the sick list of the ship's company, the deterioration of water and provisions, &c. entail upon the commander of the expedition: and when, as regards the case of Captain P. P. King, it is added that that part of the coast of Terra Australis which was entrusted to his survey, far from presenting any of those interesting and picturesque features which by enhancing curiosity relieve anxiety, was mostly barren, and displayed, with few exceptions, only flat, low shores bordered by shoals and reefs or studded with an impervious growth of mangrove trees, rarely supplied with fresh water, and inhabited by an intractable race, whom nothing could conciliate, or deter from murderous designs; when it is considered that the act of landing to explore or to take observations was generally attended with a struggle for life, and that the nearest place from whence effectual assistance could be obtained in the case of any damage which the vessel might sustain, was as far off as New York is from Liverpool, and that, in consequence of this circumstance, the completion of 2700 miles of survey required nearly 40,000 miles of sailing; when all these difficulties, which Captain King in his Australian survey had to encounter, and all of which he surmounted, are duly considered, the merit which would attend the execution of so extensive a survey under common circumstances is indeed greatly enhanced.

His work on this survey and the atlas appended to it bear the date of 1827, and form a most valuable reference in all questions, whether nautical or scientific, connected with Terra Australis.

Much, however, as had been effected, some details in the description of the coast, particularly portions of the N.W. coast, still remained to be filled up, having hitherto escaped the notice of, or not having been visited by, any navigators. The following is the account which Captain P. P. King has furnished of the voyage of Her Majesty's surveyor-ship, "Beagle," which was sent out to complete what still remained to be done.

"The 'Beagle,' left England originally under the command of Captain J. C. Wickham. This officer, however, after two harassing voyages to the north-west coast — in which several interesting points were established, and two rivers (the Adelaide and the Victoria) discovered — was necessitated to return to England, on account of bad health, brought on by the extreme heat of the climate, when the command devolved upon Captain J. L. Stokes, who has completed the objects of her voyage, and now takes her home — to receive, it is hoped, the reward of his long and useful services.

"To describe the work performed, in the succession in which it was executed, would be out of place here. It is better, therefore, to give a general summary of the different portions of the survey in the order, as to *position*, in which they follow each other.

"Commencing, therefore, with the eastern coast. The inner route towards Torres Straits was twice navigated on the way to the north coast, and several important corrections and additions made to the charts now in use. Of the latter may be mentioned, the determination of a better outlet than the one to the north of Wednesday and Hammond Islands, viz. by passing through Endeavour Strait, which hitherto has been considered to be too shoal for vessels of large burthen. Captain Stokes has, however, ascertained, that by keeping nearer to Wallis Isles, a good channel or outlet exists in which there is not less that five fathoms water. The passage, therefore, through this part of Torres Straits has been very much improved.

"The next important feature of the 'Beagle's' voyage was the discovery of two considerable rivers at the bottom of the Gulf of Carpentaria, flowing through a fine country in a south-westerly direction for sixty miles, navigable for thirteen miles for vessels of thirteen feet draught, and to within five miles of where the water is fresh; the boats, however, traced it for nearly fifty miles further, to the latitude of 17° 59′ and longitude 139° 30′. The climate was found, in the month of August, to be of an agreeable character, the thermometer in the month of August indicating an average temperature of 60°, the minimum being 50°. To these rivers the names of Albert and Flinders were given. The character of the country is low, and the soil chiefly alluvial. No satisfactory reason has been given for the low temperature of this tropical region, which, as the latitude is about 17°, ought to have been at least 70° or 75°. The situation of these rivers may at no distant period open a road to the interior, which is at present wrapped up in doubt and mystery.

"The next discovery in succession, to the west, was that of the Adelaide River, at the north-west part of the Gulf of Van Diemen, similar in character to the Alligator Rivers, which were discovered in the year 1818, falling into the gulf at its southern part. Proceeding farther, another river was found of more importance, as to size, than any previously known in Intertropical Australia. It was called the Victoria. It extends for about 150 miles to the S. E. by E. and is navigable for vessels of burthen for sixty miles from the entrance: its further examination was made by a pedestrian party to the latitude of 15° 96′ and longitude 130° 52′, and was left still flowing from the south-east. This position is about 500 miles from the centre of the continent. The character of the river may better be understood from the following extract from Captain Stokes's Journal: — 'The valley through which the river passes varies in its nature, from treeless, stony plains, to rich alluvial flats, lightly timbered with a white-stemmed gum; the banks are steep and high, thickly clothed with the *Acacia*, drooping *Eucalyptus*, and tall reeds. There was no perceptible stream in the upper reaches; but, if we may judge from the inclination of the stems of the trees growing in the bed, and heaps of large boulders in the channel of the river, the Victoria, at some recent period, must have been a large and rapid river.'

"Whilst employed in making observations at Cape Pearce, which forms the north entrance of this river, Captain Stokes was treacherously speared by the natives; the wound was a severe one, but assistance being rendered, his life was happily saved. It is a curious coincidence that the three officers whose services as surveyors in the late expedition have been most prominent, viz. Captain Stokes, Mr. A. B. Usborne, master, and Mr. Fitzmaurice, mate, each met with serious wounds in the prosecution of their duty, — Messrs. Usborne and Fitzmaurice, from muskets accidentally exploding: the former was obliged to be invalid in consequence, and the latter, who, however, has persevered to the last, will be lame for life.

"The rivers Albert and Flinders to the eastward, and that of Victoria to the westward, converge in the direction of their sources apparently to one common point; to which also do the intermediate rivers — the Alligators and the Adelaide. It seems probable that all derive their origin from some large inland marsh or lake, to which they serve as drains. It is not unlikely that there may be a low tract of land between the Gulf of Carpentaria and the Great Horseshoe Swamp, found by Mr. Eyre in the northern part of the province of South Australia.

"With respect, however, to the climate of the country, in the neighbourhood of the Victoria, the temperature, ranging between 95° and 110°, was found by the 'Beagle's' officers in the month of November to be almost insufferable, and quite different to that experienced at the Albert, in the Gulf of Carpentaria. It would seem from Captain Stokes's description above inserted to resemble in character the country about Cambridge Gulf, which has its embouchure to the sea, a short distance to the westward.

"The next part of the north-west coast visited by the 'Beagle,' was the opening that was supposed to exist at the back of the Buccaneer's Archipelago. Perhaps no part of the whole coast promised to be of greater interest, and raised hopes of the existence there of a large river,— hopes that were justified by the great rise and fall of the tides, which exceeded thirty-six feet. It was, however, found to be but a comparatively unimportant indentation, the eastern part or Collier's Bay being nothing more than a shallow sinuosity of the coast line, and the western part narrowed gradually into a tolerably extensive sound, terminated by Fitzroy River, which was traced for twenty-five miles in a southerly direction, draining the lowland from and through which it flowed. The opening near Cape Latouche-Treville, which was thought also to be another outlet of the supposed river, or else the mouth of a second, was an open bay not affording even sheltered anchorage. The interval between this part and Deputch Island was also explored, but not found to contain any inlet or feature of importance. It is generally a sandy and low sterile coast, fronted by a shoal approach and several sand-banks, the positions of which were ascertained. The Monte-Bello Islands were also correctly and minutely surveyed, as also some rocks in the neighbourhood, which are doubtless the Trial Rocks of former navigators.

"On the west coast, the Houtman's Abrolhos was also explored and surveyed, together with the coast within it, where the fertile appearance of the coast gave strong indications of the presence of a country favourable for settling. It is here that Governor Grey recommended the Australind Company to establish themselves. Fortunately, however, they had located themselves at the inlet called Port Leschelnault: for they afterwards ascertained that the former would not have suited their wants. Several new anchorages about Rottnest and Gage's Road, off Swan River, were also examined and surveyed, in which much advantage will be derived by the colonists at Western Australia.

"South Australia has also had the advantage of the 'Beagle's' services in the survey of the anchorage and port at Adelaide.

"But perhaps the most important — because useful — work performed by the 'Beagle' has been the detailed survey of Bass's Strait, which has been just completed by Captain Stokes, with the aid of the government of Van Diemen's Land, which, in the most liberal way, at once acceded to the request of Captain Stokes, by devoting to his services the use of the colonial cutter 'Vansittart,' for the survey of the southern portion of the eastern entrance of the Strait. The command of the vessel was temporarily given to Mr. C. C. Forsyth, mate of the 'Beagle.'

"The result of these labours has been the completion of the survey, in which the proper and relative position of the various headlands, capes, and islands, which are so prominent and numerous in the Strait, are laid down; with the tides, soundings, and description of several new anchorages, in a manner that cannot but be of immense importance to the commercial interests of the colony. Much important information relative to the entrance of Port Dalrymple, as well as that of Port Phillip, and the channel within it, the approaches to and anchorages to the southward of Corner Inlet, have also been furnished by the operations of the 'Beagle' during this important survey. Much labour and personal exertion have been bestowed upon this work, and too much praise cannot be given to those who have been prominent therein. It may be, however, necessary to say, that it was commenced by Captain Wickham, and completed by Captain Stokes.

"This, however, would not have been the last work which the 'Beagle' would have performed for the colony, but for obstacles which unexpectedly presented themselves, and prevented Captain Stokes from making a survey of the neighbouring coasts of Port Jackson. The necessity for a chart of the coast is very urgent, from discrepancies which have been found to exist in the only chart now in use, and the principal materials for it have been from time to time prepared as the 'Beagle' passed up and down the coast. It is to be lamented that this desirable matter could not have been accomplished.

"It is unnecessary to follow the 'Beagle' with more detail through her various movements upon the long and tedious service upon which she has been employed. Suffice to say, that the fruit of her voyage has been of the greatest importance to the navigation of the coasts, which will be amply proved when the charts of her voyage, particularly that of Bass's Straits, are published, and placed within the reach of navigators, by whom alone, from the unpretending manner in which the work has been performed, it can be estimated as it deserves." *

With the above briefly described survey of the

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* From the "Sydney Herald" of February 10th, 1843.

"Beagle," which will be more fully detailed in the forthcoming work and charts of Captain Stokes, terminates one of the most extensive series of coast surveys ever undertaken. For completeness, skill, and the strict accuracy with which they were executed, and in the important bearing they have on navigation and commerce, the charts of these surveys may be said to rank foremost amongst the documents of British Hydrography.

LAND SURVEYS.

On that immense continent to the shores of which the above reviewed marine surveys are confined, five colonies have been established. Each of these has, with more or less spirit, carried on the work of inland discovery: each boasts with reason of having enriched the store of topographical knowledge relating to the interior of New Holland. As, however, these pages are limited to the illustration of New South Wales and Van Diemen's Land, we shall now proceed to notice only those geographical discoveries which are connected with the two above-named colonies.

The topography of New South Wales and Van Diemen's Land, like the hydrography of Terra Australis at large, has its list of successive meritorious contributors. The first to whose energy and enterprise we owe the earliest map of New South Wales is John Oxley, R. N., Surveyor-general of the colony. His two expeditions in 1815, which he undertook by order of Government, and which furnished materials for the map that followed, are the only explorations of that time accompanied by authentic records. In his expeditions westward of Sydney, to the sources of the rivers Lachlan and Macquarie, and in that which was next carried eastward of the tributaries of the Darling, as far as those of the river Hastings and Port Macquarie, he completed the discovery of that chain of mountains ranging from S. to N., which, dividing the drainage of the country into eastern and western waters, constitutes the prominent features in the configuration of New South Wales.

When on the westerly side of that chain, and only at 100 miles from it, his astonishment was great indeed to find that from 4000 feet, which was the elevation of the chain above the level of the sea, the altitude had decreased to 600 feet. On penetrating still further to the westward, the fall of the country became perceptible to the eye; but the want of provisions prevented his exploring the course of the Lachlan farther than longitude 146°, and following the course of the Macquarie through a low country, with a level and unbroken horizon to the west, brought him only to a marsh, in which that river ended; so that he was naturally led to conjecture that the westerly waters of New South Wales most probably lose themselves in the marshy interior of New Holland.

Captain Sturt rectified this notion by penetrating beyond the marsh, and discovering that its superfluous waters were drained by the river Darling, which he found the Castlereagh and Bogan rivers joined. The Darling, flowing from the N. E., was a new discovery: its course at the point at which Captain Sturt left it, was S. W. (145° 30′ E. longitude, and 30° 20′ S. latitude); and beyond that point nothing was known. In 1830, Captain Sturt again proceeded from Yass Plains westerly; and keeping along the banks of the Murrumbidgee, discovered its junction with the Lachlan. Here, the river offering a better route than the land, he descended it in a boat, and, in the progress of his journey, came to a second confluence, formed by a river from the S. W., to which the name of Murray was given; and further still, in latitude 34°, to a third, formed by a N. E. river, which had all the features and characteristics of the Darling, where he left it in latitude 30° 30′. From this junction it took Captain Sturt nineteen days to reach Lake Alexandrine and the sea (E. long. 139°), the farthest westerly point that had ever been attained in an overland journey of discovery started from the eastern shores of this continent.

The two expeditions of Captain Sturt thus achieved the important discovery, that the drainage of all the westerly waters of New South Wales is effected by one river, which disembogues through Lake Alexandrine into the sea.

Mr. Allan Cunningham, King's Botanist, started, soon after this, for Moreton Bay, by land; and keeping from Liverpool Plains to the westward of the dividing range, which he re-crossed not far from Moreton Bay, succeeded in reaching latitude 27° 50′. His expedition, notwithstanding that the special object he had in view was foreign to geographical discoveries, benefited the latter, as in its pursuit he bisected all the tributaries of the river Darling, and reached its sources.

Sir Thomas Mitchell's three expeditions, which he undertook by order of Government in 1832 and 1836, verified all Captain Sturt's previous discoveries. In his northerly course in 1832, Sir T. Mitchell penetrated farther than Sturt, and came on the Darling in latitude 29°. The westerly limit of his journey in 1835 was longitude 140° 40′; the southern in 1836 was latitude 28°.

The great benefit which resulted from Sir T. Mitchell's expeditions, besides that of corroborating all the geographical features and positions previously ascertained, and determining many new ones not less important, was the discovery of Australia Felix:

for the honour of this discovery must be considered due to him, since, though not the first who saw the region, he was the first to make known to the public what he saw.

It is true that the Van Diemen's Land graziers knew the country well, and grazed it with their stock long before the arrival of Sir T. Mitchell at the Glenelg. They had also similar stations at Port Phillip, as far even as the S. side of Mount Macedon; but, as they kept their knowledge secret, and used it merely for their own benefit and convenience, they can now only boast of their good fortune in having found the country, but not of the honour of having *discovered* it.

With the admirable surveys of Mr. Tyer between Port Phillip and the river Glenelg, and of Mr. Dixon at Moreton Bay, in 1840; and with the discovery of Gipp's Land made, in the same year, by the writer of this Volume, and accounts of which are fully detailed in the parliamentary papers of 26th August, 1841, closes the record of the journeys of discovery in New South Wales.

In Van Diemen's Land, the expedition in 1835 of the late surveyor-general, Mr. Frankland, was productive of many valuable discoveries. They were confined chiefly to the upper country of the island, and to the part which lies to the southward of Macquarie Harbour.

My own wanderings in Van Diemen's Land in 1841 and 1842 led to no discoveries of any importance: they secured nevertheless the object which they had in view, namely, the tracing of the great dividing range of mountains from Cape Portland to South Cape, and the determining of the position of the most characteristic and prominent topographical features of the island. Finally, the expedition of His Excellency, Sir John Franklin, to Macquarie Harbour in 1842, not only confirmed all the positions previously ascertained, but was instrumental to defining the course of that range which flanks the eastern part of Macquarie Harbour.

To the materials thus furnished for constructing a correct map of New South Wales and Van Diemen's Land, the partial surveys of crown grants and crown lands would have been a most valuable addition, if those surveys had, at the outset, been based, not as they were upon the magnetic meridian, but upon a series of true meridians, each forming the base of a series of surveys of which the lines should have been made to correspond. This oversight must not, however, be attributed to any want of talent in the men entrusted with the surveys in either of the two colonies, but to the erroneous principle which had been laid down for them to act upon, by a department superior to theirs. Startling as it may appear, it is nevertheless true that these partial surveys, which cost the Government the enormous expenditure of more than 200,000*l.* have given rise only to conflicting claims and interminable litigations amongst the land-owners in both the colonies; while they do not furnish one single element worthy of being used in the projecting of such a map as the present state of topographical science requires.

Thus, as regards New South Wales, the construction of the existing map entailed upon Sir Thomas Mitchell, the surveyor-general, the necessity of making a new survey of the already surveyed country; which latter survey, based this time on true meridians, and on triangulation, and conducted with an accuracy highly creditable to the surveyor, produced the only topographical work of merit which has appeared.

Thus again, Van Diemen's Land, deprived as it has been of a trigonometrical survey, has actually no chart deserving the notice of science.

To our summary of the hydrographical and topographical labours which have determined the horizontal aspect of New South Wales and Van Diemen's Land, we must add here the results of the hypsometrical survey, which has furnished data illustrating the vertical configuration of the two colonies.

The elements of that survey are of the highest value, as they tend not only to the deduction of the mean altitudes of the colonial areas to which they refer, but each separate element forms a valuable adjunct in the prosecution of the geological, mineralogical, climatological, botanical, and agricultural inquiry which will follow.

In the absence of any trigonometrical survey, the altitudes of all the mountain chains and peaks, the lakes, plains, and rivers, which we shall now give in a tabular view, with the names of the observers, have been determined by the barometer.

With the exception of the instrument carried by the late Mr. Cunningham, all those used in the survey were Gay Lussac's Syphon mountain barometers. Those of Captain P. P. King, R. N. and of his son, Mr. P. G. King, were of French construction: those used by me (12 in number) had been made under my directions by Messrs. Troughton and Simms, with a division carried to one-thousandth part of an inch; and in the excellent results they gave, could stand a comparison with the best mountain barometers constructed by Bunten.

The check on the errors which may have arisen in the barometrical survey, was the back survey, whenever such could be effected. In addition to that precaution, I used two barometers in each observation, and took the mean of their indications. I also used the boiling-water apparatus of Dr. Wollaston, constructed by Messrs. Troughton and Simms.*

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* The computation of the altitudes was made according to the formulæ of the "*Astronomical Tables,*" &c. of Francis Baily, Esq.

Altitudes, in English Feet above the Level of the Sea, of the most remarkable Mountains, Lakes, Water-courses, Plains, and Stations in New South Wales and Van Diemen's Land.

NEW SOUTH WALES.

			English feet.	
Peel Plains, New England			1800	Cunningham.
Mount Mitchell			4120	
Mount Lindesay			5700	
Mount Sturt			3735	
River Condamine	(Lat. 28° 10′	long. 151° 40′)	1402	
Rocky Creek			1717	
Brushy Valley	(Lat. 28° 20′	long. 151 °20′)	1504	
Apple Tree Flat			1091	
Dumaresq River	(Lat. 28° 55′	long. 150° 40′)	840	
Glen River	29°	151° 35′	1049	
Gwydir River	29° 35′	150° 25′	895	
Mount Hundawar, or Harkwick	30° 15′	150° 25′	2545	
Barrow Valley	30° 40′	150° 20′	808	
Wallambora Ford	30° 40′	150° 25′	1016	
Mount Bathurst	31° 5′	151° 50′	4000	Oxley.
Glen Apsley River	31° 5′	152°	1000	
Bathurst Cataract, New England			235	
Beckett's Cataract ”			150	
Mount Sea View ”			6000	
Macquarie Cataract	(Lat. 31° 55′	long. 148° 10′)	680	
Summit of Lapstone Hill (Cook)			747	Capt. P. P. King.
Springwood (depôt) (Cook)			1147	
Station on the Mount Road, Cook (Blue Mountains)			1707	
Caley's Rupulse, Cook (Blue Mountains)			1868	
Twenty-four Miles Hollow, Cook (Blue Mountains)			2738	
King's Table Land, Cook (Blue Mountains)			2790	Strzelecki.
Stone quarry on the right, one mile beyond King's Table			2882	Capt. P. P. King.
Weather Board Hut			2844	
Mount Hay			2425	Strzelecki.
Mount Tomah			3240	
Foot of Mount Victoria (Flagan's House)			2607	Capt. P. P. King.
Mount George			3620	Strzelecki.
Bridge over Butler's Rivulet, Vale of Clywd			2188	Capt. P. P. King.
Mount York, Vale of Clywd, Blue Mountains			3440	Strzelecki.

	English feet.	
Foot of Mount York, Collet's farm (Mr. Morris's)	2180	
Mount Adine, flanking Reedy Valley, West	3736	
Ford at Cox's River, Vale of Clwyd	2052	Capt. P. P. King.
Walerawang (farm and estate of Mr. Walker)	2410	Strzelecki.
Dividing range, S. W. of Walerawang	3480	
Fish River, on the road to Bathurst	3220	
Military station (barracks) Blue Mountains	3010	
Badger Brush Ridge	3290	
Police station, dividing range, Bathurst	2910	
Cox's River, before reaching Blaxland's	2266	Capt. P. P. King.
Mount Blaxland, the highest summit	3256	
Jock's Bridge	2921	
Hill beyond Jock's Bridge	3496	
Bathurst Town	2310	Strzelecki.
Woodstock	2600	
Guwong, Nicholson's farm	2950	
Summer Hill, Frederick Valley	3010	
Boree Plains	1560	
Mount Canoblas, Wellington	4610	
Captain Ryan's, Boree station	1992	
Molongorang (Mr. Passemore's)	2062	
Heregal (Mr. Maxwell's station)	1616	
Macquarie River at Wellington	1439	
Guantewang, N. E. of Wellington Vale	1410	
Camden (estate of James M'Arthur, Esq.)	248	Capt. P. P. King.
Mount Prudhoe (summit above the road)	1006	
Stone quarry creek, below the bridge	482	
Crisp's Inn, Myrtle Creek, Camden	783	
Bed of Myrtle Creek ,,	643	
Bargo River, ford ,,	771	
Lapton's Inn ,,	1206	
Little Forest Hill, half a mile beyond the turning of the road	1923	
Cutter's Inn, Camden	1967	
Mittagong Range, summit, or new line	2454	
Cordeaux farm	2222	
Cockatoo Hill	2356	
Berrima Inn	2096	
Bed of the Wingecarrabee River	2058	
Bed of Black Bob's Creek, under the bridge	2051	
The Kentish Arms Inn, three miles beyond Midway Rivulet	2028	
Bed of Midway Rivulet, Camden	2003	
Summit of Stony Hill	2400	
Wombat Brush, terrace above Paddy's River	2128	
Ford of Paddy's River, Camden	1856	
Arthursleigh (estate of Mr. H. M'Arthur, Argyle)	1977	

	English feet.	
Norwood, Argyle	2116	Capt. P. P. King.
Rosseville House	2057	
Breadalbane Plains	2278	
Summit of hill S. of Wallagoray	2606	
Tarrago Ponds, Argyle	2264	
Ajimatong Cottage (verandah)	2148	
Therolonong, summit above Ajimatong	3108	
Lake George Gap	2151	
Gidleigh, estate of Captain P. P. King	2358	
Sugar Loaf, or Squall Hill, near Gidleigh	3288	
Saddle Hill ,,	3001	
Rocky Bridge ,,	2695	
Big Creek, near the gap through the Black Range	2979	
Head of Big Creek and Stony Creek	3136	
Summit of Prospect Hill	3275	
Last Hill	3176	
Wollondilly River, below Rosseville	1971	
at the junction of Paddy's River	1840	
at the ford of Arthursleigh	1830	
at Detley crossing place	1752	
Summit above Ajimatong (W.)	2718	P. G. King.
Gundaroo, Murray	1746	
Davies Inn	1539	
Gum Tree Summit	1490	
Yass River Rivulet	1311	
Green's Inn	1204	
Burton's, Murrumbidgee River	806	
Broadribbs	799	
Ellerslie (sheep station of Hannibal M'Arthur, Esq.)	1261	
Nackie Nackie Hill	2242	
Dutzton, a sheep station of P. King, Esq., (Lat. 35° 27′ long. 147° 53′)	1844	Strzelecki.
Walerogang, on the river Hume	753	
Camp under the Snowy Range	1223	
Mount Kosciuszko, Australian Alps	6500	
Mount Dargal ,,	5490	
Mount Pinnabar ,,	4100	
Cowrang Creek ,,	1350	
Dividing range in the Omeo country	3800	
Source of the Mitta-Mitta River	1850	
Lake Omeo	3100	
Second branch of Mitta-Mitta River	1900	
The average height of the flats in Gipp's Land	210	
Range between Gipp's Land and Port Western	2510	
Mount Wilson, Wilson's Promontory	2350	

Islands of Bass's Straits.

	English feet.	
Rotondo	1130	Capt. Stokes.
Devil's Tower	350	
Hogan Group	430	
Curtis Island	1060	
Mount Quoin, Flinder's Island	736	
The Patriarchs	830	
Sugar Loaf	1410	
Strzelecki's Peak, Flinder's Island	2550	
Mount Munro	2300	
Clarke Island	690	

VAN DIEMEN'S LAND.

Mountains.

Mount Humboldt, Western Range	5520	Strzelecki.
Mount Ben Lomond, culminant point	5002	
, N. W. point	4354	
, South Bluff	4500	
Cradle Mountain, north of Lake St. Clair	4700	
Dry's Bluff, Western Tier	4590	
Mount Wellington, Flagstaff	4195	
Mount Arrowsmith, between Frenchman's Cap and Lake St. Clair	4075	
Western Tier, opposite Mr. Groom's station	3915	
Ben Nevis	3910	
Frenchman's Cap	3801	
Black Range, vale of Belvoir	3381	
Four Miles Rise, river Forth	2957	
Gad's Hill, river Mersey	2588	
Table Land, forming the base of Ben Nevis	2327	
Table Land, watered by the North Esk	2220	
Mount St. Patrick	2277	
Mount Stokes	2039	
Mount Herschell	1200	
Range between Mr. Whittle's farm and Watery Plains	1506	
Signal Hill (Mr. Kesmode's)	992	
Asbestos Range	1700	Capt. Stokes.
Mount Arthur	3900	
Badger's Head	1300	
Mount George, Signal Station	617	
Sugar Loaf, near Mount George	642	
Summit over fourteen miles Bluff	320	
Government Cottage, Georgetown	23	

	English feet.	
Lantern of Lighthouse on Low Head	140	Capt. Stokes.
Mount Direction	1233	
Valentine Peak	4000	
Mount William	730	
Mount Pearson	300	

Lakes and Watercourses.

Great Lake	3822	Strzelecki.
Arthur's Lake	3388	
Lake St. Clair	3239	
Source of the Nive	4033	
Source of the Leven	2404	
River Mersey (crossing place to V. D. Land Company's Station)	1012	
River Forth (crossing place, Circular Pond Marshes)	796	
Junction of the Tyne and South Esk	700	
Junction of the North Esk with a tributary from Ben Lomond	929	
Junction of the two branches of the River King	2150	

Towns and Stations.

Government Hut at the Traveller's River	3949	Strzelecki.
Sheep station of Mr. Wood at the Great Lake	3822	
Sheep station of Mr. James Clark, north of Marlborough	3124	
Bronte, Marlborough	2912	
Marlborough	2858	
Vale of Belvoir (V. D. L. Company)	2930	
Middlesex Plains (V. D. L. Company)	2709	
Government Hut, at the foot of Frenchman's Cap	2157	
Chilton, a station of the V. D. L. Company	2106	
Regent's Plains (Mr. Wood's station)	1892	
Hampshire Hills (V. D. L. Company's station)	1348	
Oatlands	1308	
Circular Pond Marshes	1140	
Mr. Reid's farm	963	
Caldstock	901	
Captain Lloyd's farm, Westbury	860	
Patcham (V. D. L. Company's farm)	839	
Arundel, Western Tier	879	
Coal Seam, Jerusalem	843	
Formosa (an estate of Mr. Lawrance)	806	
Mr. Legge's farm, Break-o' Day	848	

	English feet.	
Mr. Groom's sheep station, Western Tier	771	Strzelecki.
Adelphi (farm of Mr. Princep)	766	
Lake Mills (farm of Mr. Fletcher)	725	
Quamby's (the property of Mr. R. Dry)	691	
Cressy (farm of V. D. L. Horse Company)	654	
Blackman's Bridge	646	
Jerusalem Settlement	634	
Hummock Hill (Mr. T. Archer's station)	591	
Carrick	560	
Mr. Stieglitz's farm (Break-o'-Day)	577	
Mona Vale (property of Mr. Kermode)	585	
Campbell Town	567	
Black Boy's Plain (Mr. Talbot's)	571	
Egglestown (Mr. Headlam's)	549	
Malahide (Mr. Talbot's)	431	
Hamilton Town	346	
Mr. Steil's, St. Patrick's	243	
Rose Garland (property of Mr. Barker)	164	
Mr. Hull's house, Mount Wellington	169	
Risdon House	150	
Dr. Pugh's house, Launceston	142	
Richmond Town	67	
Ringarooma (property of the Rev. Dr. Brown)	11	

To the above table of altitudes, I may add a few other of the more important results which the hypsometrical survey furnishes.

1st. As regards New South Wales: —

The mean altitude of the *divisa aquarum*, in that colony, is 3500 feet above the level of the sea.

The average fall of its eastern rivers is estimated at 48 feet in every mile. The average slope of the land, produced by the transversal spurs, is 96 feet.

The average fall of the westerly waters is 9 feet in every mile; that of the country within 72 miles from the crest of the dividing range is 20 feet.

2d. As regards Van Diemen's Land: —

The mean height of the *divisa aquarum* is 3750 feet above the level of the sea.

The average fall of the eastern rivers is estimated at 93 feet in every mile; and the average fall of the country, at 120 feet.

SECTION II.

TERRESTRIAL MAGNETISM.

THE institution of a system of corresponding observations, organised, in 1829, by Humboldt and Kupffer for the advancement of the science of terrestrial magnetism, and the example which was set by Gauss in the establishment of fixed observatories on the Continent, was soon followed by the English government, which, at the instigation of the British Association, granted the necessary sums of money for the erection of magnetic stations throughout the British Empire.

The Royal Society, which was deeply interested in the undertaking, imparted, through the able exertions and the ingenuity of Professor H. Lloyd of Dublin and Lieutenant-Colonel Sabine, a character of superiority, to all the established observatories which the magnetic continental stations could not boast of; as, to the arrangements for a strict simultaneity in taking the observations, was joined an exact similarity of instruments and a uniform method of observing.

The superiority of this plan was recognised by the accession of 22 continental observatories to the compact which governed those of Great Britain; and, as a striking and characteristic feature of the advance and results of civilisation, it may be here mentioned that this accession formed a scientific league, in which the governments of Great Britain, France, Austria, Russia, Prussia, Belgium, Spain, Bavaria, the United

States, the Pacha of Egypt, the Rajah of Travancore, and the King of Oude were all peaceably united in the common interest of promoting the science of terrestrial magnetism.*

Great Britain numbers in that league twelve magnetic stations, viz. those of Greenwich, Cambridge, Dublin, Kelso (the private one of Sir Thomas Brisbane), Simla, Madras, Singapore, Bombay, Toronto, St. Helena, Cape of Good Hope, and Van Diemen's Land.

The last of these observatories was established in Hobart Town towards the end of 1840, by the intrepid navigator, Sir James Ross, then bound on an expedition to the South Pole. It was fitted up by him with the best instruments for magnetic, astronomical, and meteorological observations; and was left under the direction of Lieutenant Kay of the "Terror," a zealous, accurate, and intelligent observer, and under the protection of Sir John Franklin, then Governor of Van Diemen's Land, a friend and promoter of science, and who, to his valuable services in effecting the prompt erection of the required observatory, joined a readiness to assist the observers with his own experience and his personal co-operation.

The establishment of that observatory with the object of obtaining all the elements which were needed from that part of the world for elucidating the general question of the earth's magnetic force, has rendered the detached, unconnected, and minor observations of occasional observers of little or no value.

Amongst these, the writer classes his own labours, which he had commenced and pursued while separated from communication with the scientific world, ignorant of the association that had been formed, and which, although extensive, have, since he has examined and tested them by the standard of the present knowledge, possessed upon the subject, procured for him only the mortifying consciousness that the time which they took in making, might have been more profitably employed, and the cost of the instruments which they required, more usefully invested.

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* "Account of the Magnetical Observatory of Dublin, and of the Instruments and Methods of Observation employed there," by the Rev. Humphrey Lloyd, D.D. Dublin, 1842.

Independently of the circumstance of their being unconnected, the value of these observations is also greatly impaired by their having been made beyond the precincts of an observatory. Indeed, to any one who has the slightest idea of the nature of the observations alluded to; of the nicety and delicacy of the requisite instruments; of the accuracy with which they require to be mounted and handled; of the minute precautions which are necessary to insure successful results; and on the other hand, of the interference of external circumstances which a pedestrian explorer in the writer's situation has to encounter, such as the carelessness and clumsiness of the men who carry the instruments, the imperceptible dust which floats in the atmosphere, the effects of wind, heat, rain, and moisture, and of local attraction variously disseminated, and of various intensities, and against all of which a tent offers a very insufficient protection; to those familiar with these annoyances, the difficulties in securing good observations will be at once apparent.

The writer, then, anxious not to extend unnecessarily the pages of this volume, will limit himself to the noticing only of that element of Terrestrial Magnetism called *declination* or *variation*, and which, made under more favourable circumstances, furnishes a result which may be depended on, and which, if applied to the question of the land surveys conducted according to the magnetic meridian, may be of some value.

New South Wales.								Van Diemen's Land.							
Latitude.			Longitude.			Variation.		Latitude.			Longitude.			Variation.	
°	′	″	°	′	″	°	′	°	′	″	°	′	″	°	′
34	4	0	150	51	30	9	10E.	40	50	0	144	54	00	12	10E.
34	8	0	150	42	0	10	0	40	55	0	147	45	0	14	10
34	19	0	150	39	0	9	0	40	57	0	148	0	0	13	20
34	29	0	150	22	30	9	10	40	58	0	145	35	0	13	11
34	33	0	150	6	30	8	50	41	3	0	145	50	0	15	10
34	18	0	149	52	0	9	10	41	5	0	147	30	0	10	20
34	55	0	149	27	0	10	0	41	6	0	148	5	0	11	10
34	48	30	149	0	0	9	20	41	8	0	146	0	0	10	40
34	50	0	148	18	0	8	30	41	10	0	146	5	0	14	10
35	19	0	147	55	0	8	20	41	10	0	148	0	0	12	20
35	30	0	148	0	0	8	0	41	22	0	146	0	0	10	30
36	0	0	148	0	0	7	10	41	30	0	146	0	0	11	20
36	20	0	148	15	0	3	50	41	42	0	146	0	0	12	10
36	54	0	147	55	0	3	00	41	35	0	146	45	0	14	30
37	25	0	147	30	0	20	0	41	15	0	148	22	0	12	11
37	48	0	148	0	0	30	0	41	20	0	148	25	0	11	20
37	55	0	147	25	0	15	0	41	30	0	148	30	0	10	30
38	10	0	146	40	0	16	10	41	40	0	147	15	0	12	40
38	15	0	146	30	0	13	20	42	0	0	147	37	0	11	40
38	22	0	146	20	0	12	40	42	5	0	146	35	0	12	10
38	22	0	145	50	0	15	30	42	15	0	146	15	0	10	40
38	22	0	145	30	0	12	10	42	20	0	145	55	0	10	10
								42	35	0	147	30	0	11	10
								41	26	5	147	10	5	11	5

SECTION III.

GEOLOGY AND MINERALOGY.

INTRODUCTION.

THE main object of my visit to New South Wales was to examine its mineralogy.

The excursions undertaken with a view to that object, led me through a very wild and broken country, often difficult of access, rarely permitting a rapid progress, or affording compensation for no slight degree of labour, fatigue, and privation. Indeed, the scarcity of simple minerals was such as might have discouraged the most ardent and persevering mineralogist who ever devoted himself to the science. But, although the scope for extensive mineralogical researches was thus narrowed, the country was soon found to present a vast field for a most exciting and interesting geological investigation. Viewed through the medium of Geology, it at once assumed the aspect of an historical ground, where, in the absence of monuments and records of human generations, nature unfolds annals of wonders; not indeed, that they can be so called, as furnishing new lights thrown upon the origin of things, but as yielding additional evidence that the structure to which they relate is analogous to that of the rest of the globe.

I entered therefore eagerly on a geological examination of New South Wales, as on a *terra incognita*, without guide or guide-book, as I had not the good fortune to be acquainted with any of the previous observations upon the geognosy of the country. Hence, although the whole of that country appeared equally interesting to explore, still, unassisted as I was in a labour of such magnitude, I could not but prescribe boundaries to my survey. The geological description and map, which at the outset I had in contemplation, has in consequence been ultimately confined to the country running parallel with, and stretching 150 miles inland from the sea coast, and comprehended between the 30th and 39th degrees of south latitude.

The mode adopted in my inquiry was as simple as is the geological configuration of the country. From the circumstance of the masses and strata assuming, with few exceptions, a direction from N. E. to S. W., the determination of their horizontal and vertical positions was accomplished by means of a series of zigzag sections, made across the country, and by the examination of the flanks of the dividing range, against which the different strata abutted.

Like the Alleghany Mountains in the United States, that range was as a book, the leaves of which contained all the materials needed for the investigation, and furnished not only a key to explain the order of its superposition, but also a guide towards Wilson's Promontory, the south-eastern extremity of New Holland, which I looked upon as the closing page of the intended geological inquiry.

When, however, the course of my perambulations brought me to the edge of that promontory, and thence to the islands of Bass's Straits, and from these again to Cape Portland, Van Diemen's Land; when, further, the survey of Van Diemen's Land led me winding east and west down to Research Bay, I found such striking correspondence of parts to the explored tract of New South Wales, that as I went on

I could not resist the temptation to extend my inquiry until it finally brought me to South Cape, Van Diemen's Land, and thus joined that island and New South Wales in one geological survey.

I have arranged the descriptive parts of this survey in epochs, which the geological formations have successively marked upon the surface of the two regions.

The mineral constituents of each epoch are distinguished by a strictly mineralogical nomenclature, in preference to a geological, as the latter can not as yet be applied to Australian rocks without involving questionable analogies, or implying identities with eras of deposition in other parts of the world.

Their geological relations have nevertheless been carefully taken into account, and described in respect to locality, extent, range, height, superposition, thickness, and inclination of the strata, organic remains, and mineral contents.

Their mineralogical character has been also noticed, and the chemical analyses of some will be given.

In the shape now offered to the reader, this geological description is far below what I had hoped at the outset my labours would have enabled me to produce. Neither perseverance nor devotion to the pursuit has been wanting. But these, combined with 7000 miles which I made on foot, have procured for me only the consciousness of how little I have done, and how much is still needful to complete such a delineation as the geology of the present day requires.

And all that I have collected during five years of labour I can view only as rudiments of what science may expect at a future period from the division of labour, and from the unparalleled progress of intellectual and commercial development of New South Wales and Van Diemen's Land.

I have also prepared a geological map of New South Wales and Van Diemen's Land, upon which I have laid down and illustrated what the present description will relate in words; but that map I am unable to take upon myself to publish.

It is twenty-five feet long and five feet in width, and is on the scale of one fourth of an inch to a mile.

The geographical portion of the greatest part of that map was compiled from the hydrographical and topographical charts of New South Wales and Van Diemen's Land; where the colonial survey ceased, the continuation of the dividing mountain range (from latitude 36° to 44°), with all those characteristic features of the country which bore upon the inquiry, was projected from my field-book, in which the geographical positions had been determined either by means of astronomical or trigonometrical observation.

The barometrical survey carried out, by means of two Gay-Lussac mountain barometers, and Dr. Wollaston's apparatus for ascertaining the boiling point of water, furnished all the altitudes of the country required for the construction of a second sheet of vertical sections, which is twenty-six feet in length and three feet in width. In conformity with the very judicious recommendation of Sir Henry de la Beche, the base and the height of the sections are projected on the same scale, which is four inches to a mile, and by which projection, the eye can seize at once on the true configuration of the country, and not its caricature.

The colouring of both the map and sections has been executed according to a novel method, not perhaps, as *Montaigne* says, the best, but which is my own.

It was accomplished with four colours, divided into dark and light shades, the dark denoting the mineralogical, and the light the geological character. Thus, the light pink, light yellow, light blue, and light sepia, represent the first, second, third, and fourth of the geological eras; while the darker shades of the same colours represent the four classes of rocks; viz. the siliceous, argillaceous, calcareous, and the hornblende and augitic rocks; which again are distinguished, when crystalline, by a *moirée*, when stratified, by lines drawn in the direction of the strata.

The different species comprised under each class of rocks are indicated by small distinct marks: thus, under the siliceous rocks, granite, protogene, sienite, hyalomicte, mica schist, quartz rock, siliceous slate, siliceous breccia, sandstone, petrosilex, porphyry, are distinguished from each other by differently formed and easily remembered dots. Under the argillaceous rocks the distinctions between chlorite slate, clays, and argillaceous sandstones are yet more simple. Under the calcareous, they are very plain, and under the volcanic rocks, comprising serpentine, diabase, basalt, and trachyte, they are readily comprehended.

GENERAL PHYSICAL AND GEOLOGICAL ASPECT OF NEW SOUTH WALES AND VAN DIEMEN'S LAND.

When viewed from the east, New South Wales and Van Diemen's Land do not present any of those bold or fantastic features, by which the imagination is excited and curiosity enhanced. The foreground of the picture is commonly composed of an undulating country, richly wooded, and gradually rising westward, until it spreads into a centre ground formed of darkly verdant and round topped hills and ridges, promiscuously grouped together; beyond which rises in the back-ground a range of high land that forms an outline on the horizon, only here and there broken by peaks of striking shape and lofty elevation. In latitude 30° this elevated land assumes the aspect of a mountain-chain crowned with peaked, acicular, dentiform, sharp-edged, or flattened granitic or porphyrytic crests, from which the eye may trace its course, winding from N. E. to S. W., until it gradually vanishes in the distance. On both sides the country exhibits a sloping surface, which the countless ramified spurs, branching off eastward and westward of the chain, deeply furrow with valleys and ravines. The waters run between and parallel with the spurs; their courses commonly flow in diametrically opposite directions.

At the point from whence this bird's-eye view is taken, that is at the 30° of latitude, the granitoite chain divides the sources of the river Peel, running to the westward, from those of the Hastings, flowing N. E. towards Port Macquarie. Further to the south, one of its eastern spurs of porphyry separates the river Manning from the river Hunter, after which, assuming a direction almost west, it divides in its windings the various tributaries of the Hunter from those of the Peel river. This part of the chain is commonly called Liverpool range, and is crowned by several peaks of greenstone, which rear their naked, conical, and distorted tops to the elevation of 4700 feet. From two of these, Mount Oxley and Mount M'Arthur, the eye is presented with a most beautiful panorama of broken country, blending into the Liverpool plains on the one side, and into the fertile valley of the Hunter on the other. To the westward of these peaks, and at the point where it divides the river Goulbourn from the Talbragar, the chain turns suddenly to the south-east, but resumes again its south-westerly direction at a locality rendered remarkable by the peaks of Coricudgy and

Payan, and the sources of the Colo and Cudgegong. On reaching Cullenbullen, the chain is granitic, and throws off a remarkable basaltic spur to the eastward, the curious sub-ramifications of which, render all that sandstone locality commonly called Blue Mountains, difficult to approach, and yet more difficult to explore. Mount Adine (4050 feet), Mount Clarence (3500 feet), Mount King George (3620 feet), and Mount Tomah (3240), crown the northern branch of that spur. Mount Hay (2400), and King's tableland (2790), surmount the southern. Between these ranges lie yawning chasms, deep winding gorges, and frightful precipices. Narrow, gloomy, and profound, these stupendous rents in the bosom of the earth are inclosed between gigantic walls of a sandstone rock, sometimes receding from, sometimes frightfully overhanging the dark bed of the ravine, and its black silent eddies, or its foaming torrents of water.

Every where the descent into the deep recess is full of danger, and the issue almost impracticable. The writer of these pages, engulfed in the course of his researches, in the endless labyrinth of almost subterranean gullies of Mount Hay and the River Grose, was not able to extricate himself and his men until after days of incessant fatigue, danger, and starvation.

" Some idea," says Sir T. Mitchell, in his work on Australia, " may be formed of the intricate character of the mountain ravines in that neighbourhood, from the difficulties experienced by the surveyors in endeavouring to obtain access to Mount Hay. Mr. Dixon, in an unsuccessful attempt, penetrated to the valley of the Grose, until then unvisited by man; and when he at length emerged from the ravines in which he had been bewildered four days, without ever reaching Mount Hay, he thanked God (to use his own words in an official letter) that he had found his way out of them."

The ascent of Mount Hay, when these difficulties are once surmounted, repays richly the exertions and fatigues which it entails. From its basaltic top, the distant views to the south and west are somewhat intercepted by King's table-land, and other mountains higher than Mount Hay; but to the east, the sea coast, bordering the interesting basin through which flow the rivers Nepean and Hawkesbury, the vicinity of Paramatta river, together with Sydney and Botany Bay, are distinctly visible. To the north also the prospect is extensive. At the foot of Mount Hay lies, in the foreground, the river Grose, in a sandstone ravine, the perpendicular depth of which is 1500 feet. On the further side of the torrent rise the steep basaltic eminences of Mounts King George and Tomah *, deeply clefted, and beyond in a strong

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* Captain Town's Farm, Mount Tomah,
8th September, 1839.

The current of the river Grose and its precipitous banks frustrated all my efforts to regain Mount King George, on the side of Mount Hay, and obliged me to go round by the source of the river, crossing on the way all its tributary torrents, and plunging anew into those savage solitary defiles which remain in the same state as when the black men first surrendered them to the white.

Some days spent in toilsome climbing and scrambling brought me at length to Mount King George. Mount Tomah appeared quite close to it; but immense ravines lay between, and torrents of rain in a great measure concealed the view. To proceed onwards was, however, my only alternative. I therefore redoubled my pace; ascended and descended; climbing, sliding, and clinging, until at length I found myself in the midst of a forest of high and thick fern, bending beneath the weight of the still falling rain, and my progress through which resembled the act of swimming rather than of walking. The temperature, however, had hitherto rendered that progress bearable; but on approaching the summit of the mountain it changed; showers of hail began to fall, and were soon succeeded by a frost. My clothes stiffened on my limbs; the latter began to feel numb, and I soon felt it would be necessary to abandon the prosecution of the observations I had wished to make. I therefore began to descend the mountain, anxiously seeking, right and left, for some friendly cavern where I might be able to kindle a fire and dry my clothes. Three hours were vainly spent in search of one — night approached — the heavens lowered — the rain and hail continued to pour. The nearest habitation, as I had been informed, lay relief, the predominating summits of the Payan and Coricudgy mountains.

Resuming the survey of the chain at the point

eighteen miles off, in the direction of the river Hawkesbury: fortunately for me, one, of which I had heard nothing, presented itself suddenly before my eyes. To perceive it—to utter a cry of joy—to encourage my exhausted and helpless servant, and to fly towards it, was the act of the same moment. To recognise our state of distress and to relieve it, was a part the owner of the dwelling performed with equal promptitude.

He took off my wet clothes, wrapped me in others from his own wardrobe, placed me before a blazing fire, brought me food, and surrounded me with every comfort, without once asking who I was, whence I came, or what might be my business!! My memory furnishes me with the recollection of few transitions so sudden and so agreeable; few states of discomfort transformed within the space of a few minutes into one of comfort so complete, and still fewer traits of hospitality so truly primitive.

The Evening of the 10th of September.
In a Cavern of Mount King George.

The host who so generously received me the day before yesterday, and with whom the state of the weather obliged me to remain until to-day, is a true son of the glebe. He was born in the fields, took root there, and has there flourished.

He arrived in the colony ten years ago as a simple labourer, and is now the successful cultivator of two farms, sorrounded with all the rude abundance of rural life, and having servants under him; though he by no means aims at playing the part of a master; but, on the contrary, eats at the same table with his dependents, accompanies them to the field, and sows and reaps with them as in former times, whether from an innate love of the occupation or as a grateful recognition of the prosperity with which he has been blessed.

The attentions he showed me, though somewhat *empressés*, were as benevolent and as simple as is the nature amongst whose works he dwells. His language was characterised by the unerring signs of that simplicity. I can fancy that I see him now, as he appeared yesterday entering my room, his head covered with an old hat, carelessly worn on one side, and broken in at the crown; the sleeves of his shirt tucked up, and holding in one hand a knife, in the other a fine piece of pork, fresh killed, while he good-humouredly addressed me:—

"There's going to be more rain—it already falls in the mountains—so I just killed a pig; for I thought to myself, our stranger can't leave to-day. Come, you'll stay—Yes! yes! you must stay!—Shall we boil or roast this piece?" Whereupon, without waiting for any reply, he called out to his wife, "I say, mother! he'll stay—get dinner ready!"

To-day I left his house—my knapsack completely stuffed with fresh provisions, and both myself and servant entirely recovered from our where this spur composing the Blue Mountains branches off, we see it composed of sienite and granite, and stretching for a few miles to the S. W., where it gives rise to Cox's river, and forms the Walerawang and Clywd valleys.

Proceeding further, where it is known by the name of Honeysuckle range, its direction is S. E., and the mean elevation of its greenstone crest is 4050 feet; twenty-five miles beyond, bending again to the S. W., it attains a height of 4500 feet, and its character alters. The hitherto richly wooded greenstone tops are exchanged for naked, barren, and fantastically shaped sienitic peaks: the whole extent of Westmoreland country, including the Balangola and part of the Wollondilly valleys, is also rugged, and intricately broken. To the southward of Balangola shoots off in a northward direction a spur, which separates in its windings the river Macquarie from the Abercromby. This spur has been traced for 120 miles: at eighty miles from the chain, its basaltic ridge forms Mount Canoblas; at fifty more, Mount Contumbus. Both these elevations carry the eye far and wide, over the interminable extent of the western country, and afford also a fine view of the Wellington, Macquarie, and Lachlan valleys.

The chain itself to the southward of the two spurs above described assumes, in its S. W. bend, a more smooth, rounded, and wooded aspect, less elevated, and less intersected by ravines.

At Mount Fitton, about the source of the Wollon-

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fatigue and sufferings. The debt of hospitality alone remains to be settled; for every effort to induce my host to accept a pecuniary recompence failed. He belongs to a class often calumniated; most frequently poor, and everywhere considered at the foot of the social ladder; but amongst whom — be they Pagan or Christian, idolaters or true believers — hospitality and charity are viewed as one and the same thing, and are practised as the most sacred of duties. — *MS. Journal of the Author.*

dilly, and at the head of Lake George, this character again somewhat alters. At the last-named locality, a westerly spur, composed alternately of serpentine and porphyries, and which divides the tributaries of the Murrumbidgee from those of the Lachlan river, winds its course through a very broken country. Further on, beyond Lake Bathurst, another spur branches off to the north-east, and stretches over Cambden and Cumberland, to the neighbourhood of Illawara and Shoalhaven, localities which possess the most picturesque, and the most gloomy and savage scenery. Sixty miles further south, where its previous southern course changes again to S. W., the chain in its elevation and general features becomes bolder. Its greenstone and sienitic crest at times assumes the appearance of Alpine table-land; at times rises, and breaks into sharp-edged and dentiform summits, capped here and there by snow, in the midst of summer, while the spurs which at that locality shoot from both sides of the ridge, carry with them throughout the same bold features.

That spur which to the eastward traverses Moneiro, and flanks the river Shoalhaven from its source to its mouth, renders the whole track over which it stretches a most intricately broken one. The locality of Deuna river, Mount Currumbilly, Budawang, and Pigeon's House, and the vicinity of Jarvis Bay, are intersected in all parts by precipitous and impassable gullies.

The spurs which run to the westward are not less imposing in their aspect. The forked one, which, at Mount Garangoora, winds between the rivers Murrumbidgee, Coodradigbee, and the Doomut, presents in its different parts features which, in boldness, are not surpassed by any hitherto observed. The cluster of broken peaks which mark the sources of the above rivers; the ridges which form walls as it were for their respective courses; indeed, the whole structure of the spurs about this locality imparts to them the character of bold outworks in advance of that prominent group of mountains, known in New South Wales under the name of the Australian Alps.

Conspicuously elevated above all the heights hitherto noticed in this cursory view, and swollen by many rugged protuberances, the snowy and craggy sienitic cone of Mount Kosciuszko is seen cresting the Australian Alps, in all the sublimity of mountain scenery. Its altitude reaches 6500 feet, and the view from its summit sweeps over 7000 square miles. Standing above the adjacent mountains which could either detract from its imposing aspect or intercept the view, Mount Kosciuszko is one of those few elevations, the ascent of which, far from disappointing, presents the traveller with all that can remunerate fatigue. In the north-eastward view, the eye is carried as far back as the Shoalhaven country, the ridges of all the spurs of Moneiro and Twofold Bay, as well as those which, to the westward, inclose the tributaries of the Murrumbidgee, being conspicuously delineated. Beneath the feet, looking from the very verge of the cone downwards almost perpendicularly, the eye plunges into a fearful gorge 3000 feet deep, in the bed of which the sources of the Murray gather their contents, and roll their united waters to the west.

To follow the course of that river from this gorge into its farther windings, is to pass from the sublime to the beautiful. The valley of the Murray, as it extends beneath the traveller's feet, with the peaks Corunal, Dargal, Mundiar, and Tumbarumba, crowning the spur which separates it from the valley of the Murrumbidgee, displays beauties to be compared only to those seen among the valleys of the Alps.

From Mount Kosciuszko, the chain, resuming its

S. W. direction, still maintains the same bold character, but with diminished height. To the right and left, its ramifications are crowned by peaks, rendering the appearance of the country rugged and sterile. With the exception of the vicinity of Lake Omeo, and a part of the Mitta Mitta valley, lying between the spur crowned by Mount Yabbarra, and that surmounted by Mount Ajuk, a tract resembling a vast basin, without trees, and scantily supplied with water, but covered even during a parching summer with luxurious pasture, the whole region westward of the chain, towards Western Port, is rent by narrow gullies almost inaccessible, either by reason of the steepness of the ridges which flank them, or of the thick interwoven underwood which covers the country.

The region eastward of the chain in the direction to Corner Inlet presents a totally different aspect. At the latitude 37°, or about the sources of the river Thomson, the spurs are less ramified, and of considerable height and length, shaping the intermediate ground into beautiful slopes and valleys, which ultimately resolve into a fine open plain, richly watered, clothed with luxurious grasses and fine timber, and offering charming sites for farms and country residences. Viewed from Mount Gisborne *, Gipps Land resembles a semi-lunar amphitheatre walled from N. E. to S. W. by lofty and picturesque mountain scenery, and open towards the S. E., where it faces, with its sloping area the uninterrupted horizon of the sea.

The spur which bounds the southern limit of that area, and another which, on the western side of the chain, studs the territory of Australia Felix, and the neighbouring district of Western Port, with some

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* Named after my lamented friend, the late Mr. H. J. Gisborne, son of Mr. Gisborne, M.P.

remarkable eminences, again change the face of the country, and by contrast enhance the beauty of Gipps Land. These two spurs constitute a broken inhospitable region, frequently unsupplied with water, and almost always ill furnished with either quadrupeds or birds. In the direction of Western Port, some parts of that country are rendered nearly impenetrable by the dense scrub, interwoven with grasses and encumbered with gigantic trees, fallen and scattered in confusion. The writer, obliged to cross this region from Gipps Land to Western Port, was forced, at its very outskirts, to abandon his pack-horses and collections, and, with his companions and men, to devote twenty-six days of incessant labour to extricate themselves from a situation, in which they were in imminent danger of perishing. Such were the difficulties encountered on that occasion, that, with the utmost exertion, stimulated by the sense of peril, a progress of from two to three miles per day was all that could be accomplished.

In the vicinity of Corner Inlet, the chain of mountains dips under a low and marshy ground, above which its crest appears rising only at intervals. Ten miles beyond, it is seen again erect, jutting out boldly into the sea, and exposing its granitic flanks for a length of thirty miles to the lash of the infuriated surf.

At Wilson's Promontory the sea interferes with the visible continuity of the range, but does not terminate its course.

On a fine day, that course may be traced from the top of the headland, beautifully delineated by the chain of the islands of Bass's Straits. These islands, whether high and crowned with peaks, or low and crested only by the white sparkling foam of the sea, appear, in their winding and lengthened array, like the glittering snow-capped domes of the Andes, when seen above the region of the dense clouds which bathe their lower region.

Rotondo is the nearest conspicuous island to the promontory: Moncur's, Sir R. Curtis's, and Kent's group follow, as if only to indicate the direction of the chain, which on Flinder's Island displays again an uninterrupted course of about seventy miles long. From the top of its rough and naked ridge, 2550 feet in height, are seen, to the eastward and westward, small islands, with reefs scattered alongside, which are so many crests of the branches and ramifications of the range. To the southward, Barren Island, Clark's Island, and Cape Portland are arranged, with their respective heights, in such perspective that, shutting out the intervening sea, the eye may glide uninterruptedly from the heights of Flinder's Island down to the far summits which crown the elevations of Van Diemen's Land.

Barren Island — worthy of its name — deeply indented with caves and strongly projecting headlands, exposes a bare denuded surface to the incessant stormy weather of the straits. Clark's Island and Swan Island partake of the same character: all three have nothing to offer but scenes of desolation.

From the granitic peaks of Clark's Island, the chain is seen beyond Cape Portland, in a southerly direction, gradually emerging from the ocean, and plunging into the interior of Van Diemen's Land. For thirty miles, its height does not exceed 700 feet. On arriving, however, at the point where it is commonly called Blackridge, it suddenly rises to above 3000 feet, and is seen casting to the right and left, in its S. W. course, towards St. Patrick's Head, three long ramified spurs, which, as it will be seen, stamp the whole of the north-eastern section of the island with a most striking and characteristic configuration.

The first of these spurs branches off at the source of the river Bobiala, and terminates in a cluster of conspicuous granitic hills, of which the most prominent is Mount Cameron; next to it is that spur which is crowned with the greenstone protuberance of Mount Horror, Mount Barrow, Mount Arthur, and Mount Direction, and which, stretching as far as George Town, ends with Mount Royal. The last spur is characterised by the highest elevations of Van Diemen's Land, namely, Ben Lomond and Ben Nevis, and which are likewise composed of greenstone.

It is impossible to give an adequate idea of the *relievo* which the above spurs have produced; of those endless sharp-edged ridges, which run in all directions, interbranch, and form as it were, a net-work of mountain chains woven intricately together. At times the eye can seize upon their distinct and independent courses, radiating from a common centre, and gradually sloping into flat-bottomed valleys; at times, their flanks are erect and perpendicular, imparting to the ridges an appearance of having been rent asunder, and presenting, between, dark chasms and gorges, from which roaring torrents make their escape.

From no point is the grandeur and infinite diversity of this mountain scenery better viewed than from the lofty, craggy, and precipitous battlements of Ben Lomond.

The northern extremity of the mountain overhangs profound tortuous abysses, and commands an uninterrupted view of Ben Nevis, Mount Barrow, Mount Arthur, Mount Cameron, the northern coast, and the most conspicuous peaks of the islands of Bass's Straits.

From the southern side is seen the whole eastern labyrinth of ridges and chasms, the fertile valley of the Break o' Day, together with the beautiful outline of the bays and promontories of the eastern coast.

The central part of the mountain's top, as the spectator recedes from the verge of its precipitous flanks, offers, again, views which have nothing in common with those already described. The scene is here one of unbroken solitude, silence, and desolation. On the bare earth, covered only here and there with patches of snow in the midst of summer, thousands of prismatic greenstone columns (of eight or ten feet in diameter) lie prostrate at the foot of the traveller; columns of gigantic order, chiselled by nature, and raised by her hands to this majestic elevation, where, overthrown and broken into huge fragments, their ends project over chasms 3000 feet in perpendicular depth.

From this table-land, however, of the mountain's summit, the fearful gorges, precipitous cliffs, and inaccessible ridges of its immediate vicinity disappear; while the distant masses of the western hills seem blended or levelled into one undulating valley, intersected by the windings of glittering streams of the valley of the Tamar, and bounded, on the remotest skirt of the horizon, by a finely-drawn chain of mountains.

The course of the chain, resumed at St. Patrick's Head, is found to recede from the sea, and to follow a south-westerly direction for about sixty miles, without presenting any particular features, either in its main or its lateral branches. At the point called Lake Tomb, and in the vicinity of the eastern marshes, it suddenly turns between those two localities, reaches St. Peter's Pass, and casts towards Spring Hill a spur, which separates the Coal River valley from that of the Jordan; and another, which separates the latter from the Clyde, and of which Table Mount is the principal eminence.

The dividing range next proceeds to the northward, where it divides Lake Sorrel from Lake Arthur. On arriving at Dry's Bluff, — a remarkable elevation, resembling in shape a commanding promontory, — it throws back again a spur, which encircles Lake

Arthur, and thus flanks the left side of Lake River, opposite to Miller's Bluff.

A glance from Dry's Bluff embraces all the beautiful sinuosities of the valley of the Tamar, with Ben Lomond, Ben Nevis, Mount Barrow, and Mount Arthur in the background; also those of the valley of the Meander, as far as the north coast; and the table land to the south, with the expanded waters of of Great Lake; its vast, verdant, marshy plains, stripped of timber, plentifully intersected by rivers and rivulets, and here and there broken with ravines and elevations.

Between Dry's Bluff and Western Bluff, the chain, in its semicircular bend, sends one spur to the northward, which terminates in Quamby's Bluff; and several to the southward, which divide the lakes from the tributaries of the river Derwent.

At Western Bluff, it casts to the N. E. a long spur, which separates the river Meander from the Mersey, rendering all the country which borders on Port Sorrel and the river Tamar extremely broken and hilly.

Throughout the whole distance from St. Peter's Pass to Western Bluff, the chain averages 3500 feet in height, and exhibits a greenstone crest of an extremely irregular aspect. That crest is almost every where craggy, fractured, and denuded of vegetation; its spurs steep and tortuous in their course, and angular and fantastic; and its innumerable ravines, invariably deep and dry, are strewed with masses of rock of immense dimensions.

The character which the dividing range displays to the southward of Western Bluff is still bolder: its spurs in the vicinity of Lake St. Clair, to the north, north-west, and west, are topped for the most part by more lofty, bare, and cloven summits of quartz rock and sienite, and are divided by darker gullies, the beds of which, furrowed by the torrents in yet deeper trenches, are at times impassable. The greenstone and basaltic spur which divides the Mersey from the Forth, that which separates the Forth from the Lleven, that which spreads into the Hampshire Hills and stretches to Cape Grimm, and, lastly, the one which divides the river Arthur from the tributaries of Macquarie Harbour, all partake of the colossal, rugged, wild, and distorted features which here distinguish the chain.

Below Lake St. Clair there are two more spurs which deserve a notice.

The one which divides King's river and the Gordon, and which is crowned by Frenchman's Cap, displays from its quartzose summit, scenery of Pyrenean character, unequalled elsewhere in Van Diemen's Land. That also, formed of greenstone and basalt, which separates the Derwent from the Huyon, and which terminates with Mount Wellington, constitutes one of the most striking features in the configuration of the south part of the island. From both these spurs, elevated above all the adjacent mountains, may be seen a vast extent of surrounding and far-distant country. Below the first, stretches the whole scrubby and barren tract between Macquarie and Port Davy, a great part of the western coast, and the northern and eastern eminences of the Lake country: at the foot of the latter spur, are seen, on one side the conspicuous peaks of the elevated land about Lake Sorrel, the Great Lake, Lake St. Clair, and Lake Echo, and all the numerous valleys which ultimately resolve themselves into that of the Derwent; on the other, the Coal River valley, Tasman's Peninsula and the borders of the Channel, with Hobart Town in the foreground, and the indented and projecting southern coast in the horizon.

The chain beyond these two spurs bends in a south-easterly direction, still sending forth minor branches; and studding with conical eminences the skirts of Entrecasteaux's Channel and Research Bay, until it dips under the sea, thus terminating its terrestrial course at South Cape.

We have now endeavoured to present the reader with a sketch, upon which, as upon that of an intended picture, the delineation of the geology of the two colonies will be rendered more clear and perspicuous.

Its most prominent and striking features consist partly in the character of the mineral masses which form the dividing range, which are composed of granite, sienite, hyalomicte, protogene, quartz-rock, petrosilex porphyry, serpentinous hornblende and augitic rocks; partly in the character of the sedimentary rocks, of siliceous, calcareous, argillaceous, aluminous, and bituminous character, which are confined to the eastern and western talus of that range, resting on it either in a vertical, inclined, or horizontal position.

Its main phenomena are referable to epochs of terrestrial revolutions; some relating to periods marked by a partial quiescence, and the deposition of sedimentary rocks; some to perceptible changes in the condition of the organic life inhabiting the sea; some others, again, to catastrophes which swept from the surface of the earth all its animal and vegetable kingdom.

We shall now select for our illustration of the geology of New South Wales and Van Diemen's Land such only of these epochs as we can classify by the incontrovertible evidences of superstructure, or by organic remains; and we shall review them in the stratigraphic order in which they present themselves to our investigation, beginning with those which belong to the remotest epoch.

FIRST EPOCH.

To this epoch we shall refer all the phenomena connected with the irruption of crystalline rocks amidst the submarine crust of the earth, and by which a tract of land belonging to New South Wales and Van Diemen's Land appears to have been raised, so as to preclude any farther accumulation of marine deposits.

This irrupted or upheaved land is composed either of crystalline and unstratified or of stratified rocks.

Amongst the former are —

Granite proper
Porphyritic granite
Glandular granite
Protogene
Sienite
Hyalomicte
Quartz rock
Serpentine
Eurite.

Amongst the latter are —

Mica slate
Siliceous slate
Argillite.

This tract, composed of the above specified mineral masses, and which we have distinguished upon the annexed small map by a pink colouring, appears by geological evidences to constitute the most extensive portion of the actual surface of the two colonies.

Its western limits in New South Wales seem to extend far back into the interior of New Holland, as at 160 miles from the present sea-coast such are not to be traced.

Its eastern limits are delineated by bold landmarks, and may be approximately traced by a line drawn from New England, latitude 28° 30′, longitude 152° 20′ *, down to the head of the river Hunter; whence it proceeds westerly, through the peaks of Mount Temi, Mount Terell, Mount Oxley, and Mount M'Arthur, and along the dividing range, down to the sources of the Munmurra Creek.

From about that locality, the continuity of the raised land, in the direction of the dividing range, seems to be interrupted, being indicated only by occasional outcrops. At the sources of the river Goulbourn, its eastern limits again present a well-defined outline, parallel to the dividing range. They may be thus traced through Payan Peak, Blackman's Crown, Cullen Bullen, and the vale of Clywd to Mount Murruin.

On passing the sources of the river Abercromby, the continuity of the tract towards the south is again partially interrupted, as if by an intervening arm of the sea; its boundary line here branching off east and west. On the east side of the dividing range, it passes through Arthursleigh and Glenrock, in the direction of the Shoalhaven river, approaching to within fifteen miles of the sea-coast, in the shape of a narrow neck of land. On the west side of the range, it runs in a tortuous line towards Mount Canoblas, round the eastern and northern base of which mountain it bends. The line next strikes, for upwards of fifty miles, in an indented course to the northward, in the direction of the estate of Mr. Montefiore, and then loses itself in the interior of New Holland.

At the place where the continuation of the uplifted land to the southward was interrupted, some occasional outcrops still mark its course to Breadalbane Plains, where it again appears, bending on the one side to the south east, through Mount Wollowalar, Modbury, and Mount Tomawong; and on the other,

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* Cunningham.

in a very tortuous line to the south-west, taking first the direction of the river Murrumbidgee, encircling afterwards Yass Plains; and lastly, striking, by a north-west course, through Barber's Station and the Jugion Creek range, on the western region of New Holland.

How far this portion of the raised tract extends in the interior, to S.W., W., or N.W., it is as yet impossible to decide.

On the east, its limits are most likely bordered by the Australian Alps, as they undoubtedly are in Gipps Land by the dividing range, as far as Wilson's Promontory.

To the southward of that promontory we have but the islands of Bass and Banks' straits, and which, instead of being vestiges of a former coast-line between Wilson's Promontory and Cape Portland, as some travellers supposed them to be, indicate only a submarine continuity of the irrupted chain of New South Wales and Van Diemen's Land. These islands present themselves in a form similar to that which may have characterised Van Diemen's Land after the first irruption of crystalline rocks.

At that epoch, Van Diemen's Land probably was composed of five islands: the first approaching to the form of a triangle, included between Cape Portland, St. Patrick's Head, and the head of the river Forrester; the second, constituting what are now called Asbestos Hills; the third, a small island, now forming the valley of the Lake River; the fourth, including the eastern portion of Hampshire Hills, and a part of the northern littoral; and the fifth, an oblong and indented island, comprising a part of Middlesex Plains, and enclosed between Macquarie Harbour, Port Davy, South-west Cape, South Cape, the right bank of the river Huyon, the west side of Lake St. Clair, and Western Bluff.

We shall now enter upon the mineralogical description of some of the crystalline and sedimentary rocks belonging to this epoch; under the consideration that, at the distance of the European reader from the Australian colonies, it is important that he should be put in possession of the specific character of each species of rock treated of in the geological inquiry, and thus understand the meaning of the nomenclature employed.

CRYSTALLINE ROCKS.

Granite.

Var. 1. *Granite proper.*

Composed of equal proportions of quartz, felspar, and mica. Structure granular: grains the size of a pea: dissemination of the ingredients regular: the predominant colour of the quartz, vitreous, with at times a smoky or greasy appearance; that of the felspar, a faintish red, and that of the mica, invariably black: the entire mass presents a reddish grey colour.

Localities. — Liverpool range, Bathurst, Wellington Valley, Shoalhaven, Jugion Creek, Ellersbie, Mount Kosciuszko (New South Wales). Eldon range, Ben Lomond, and Frenchman's Cap (Van Diemen's Land).

Var. 2. *Glandular Granite.*

Composed of oval-shaped masses of granular mica, tabular quartz, and tabular felspar, irregularly interspersed through a quartzose paste.

Localities. — Vale of Clwyd, Guantewang, Mount Kosciuszko, Gidley East, Modbury, Amprier West, Wilson's Promontory (New South Wales). Flinder's Island (Bass's Straits). Cape Portland and the Black Ridge (Van Diemen's Land).

Var. 3. *Porphyritic Granite.*

A granitic structure of quartz and mica, with large oblong and irregular crystals of felspar, confusedly embedded in the masses.

Localities. — Vale of Clwyd, Guantewang, Gidley, Ellersbie, Lake Omes, Wilson's Promontory, Clark's Island, Black range, Ben Nevis, and Eldon range.

Remarks. — The granite of the three above varieties exhibits in some cases evident traces of a *flow*, similar to that of a *nappe de basalte.* The first variety presents very often the appearance of an intumescent paste, forming an extensive tract of New South Wales, *where neither mica slate or gneiss is to be found.*

The two last varieties have seldom this appearance. They consist mostly of moderate ridges, and serve as bases to other crystalline, stratified, or unstratified rocks.

PROTOGENE (*Beudant*).

A confused crystallization of talc, felspar, and quartz, marked by an unequal distribution of ingredients, by the predominance of the *talc* over felspar, and by the entire exclusion of mica. Colour, a greenish white, sometimes inclining to red.

Localities. — Occupies a small isolated portion of the Manes range (Murrumbidgee), and is to be found in the Eldon range, resting on granite, which it resembles in the size and colour of the quartzose ingredient.

HYALOMICTE (*Brongniart*, *Beudant*, Greisen of the German mineralogists,)

Is composed of a homogeneous milky or smoky-looking quartz rock, with an admixture of a white mica, to the entire exclusion of felspar.

Localities. — Is found at Ellersbie and Dutzton, and crowns also Mount Kosciuszko, the highest summit of New South Wales: when associated with sienite, as is the case in the Australian Alps, it has occasionally hornblende added to it.

SIENITE.

Structure granular and massy; invariably composed of a vitreous and translucent quartz, and of hornblende, which is prismatic, and of a dark olive green. At times it is intersected by veins of sulphuret of iron, by which the already beautiful appearance of the rock becomes yet more resplendent.

Localities. — Is widely diffused through both the colonies. In New South Wales, it is found in Honeysuckle range; in Argyleshire, at Sharwin's West; and between Murrumbidgee and the Murray. It forms also the most elevated mountain in that colony (Mount Kosciuszko). In Bass's Straits, it is seen on Flinder's Island, Green Island, Mount Chappell, Preservation, and Clark's Island.

In Van Diemen's Land, it forms the eastern coast, Eddystone Point, St. Helen's Point, and St. Patrick's Head; and it is found on the Great and Little Forrester, on Mount Horror, Mount Humboldt, and at Port Davy.

Remarks. — Sienite is associated with striking uniformity with granite: its presence in any locality is a sure indication of the granite being near.

QUARTZ ROCK. (Syn. Quartz compact of *Beudant.*)

The quartz rock of the two colonies consists of two distinct varieties, the structure of which much differs, although appearing similar to the naked eye. The first variety is of a whitish or somewhat milky colour, at times translucent; it is free from foreign ingredients, and perfectly homogeneous. The second variety differs in colour and translucency, and shows, when examined with a lens, a granular structure, composed of concretions united into one mass by a paste perfectly similar to the grain: at times, as is the case at Dr. Hill's (Shoalhaven River, New South Wales), it presents the appearance of a jasperoid rock, with very indistinct concretions.

Localities.—The first variety is extensively developed about Bathurst, in Argyleshire, and on Mount Kosciuszko (New South Wales). In Van Diemen's Land, its most remarkable locality is the dividing range, west of Lake St. Clair, Frenchman's Cap, and the spur which unites that mountain to the main ridge of the dividing range, and which that quartz rock exclusively composes.

The granular variety is more generally diffused than the preceding one. In New South Wales, it is found in many places about the Upper Hunter, and particularly in Argyleshire, about Barber's Creek, Ajimatong Ridge, and Sharwin's Farm.

In Van Diemen's Land, it is principally found between the Meander and the Mersey rivers, at Rocky Cape, Cape Grimm, and the heads of the Derwent.

Remarks.—The first variety agrees in all its characteristics throughout the above-named localities, not only mineralogically, but also in its geological position and relation. This variety, in New South Wales, as well as in Van Diemen's Land, whenever it reposes upon granite proper, serves as base to mica slate.

The second variety shows evidences, both geological and mineralogical, of being posterior in date to the first. In most cases it forms the superstructure of the rocks belonging to the second epoch, under the account of which, allusion will be made to it.

EURITE (Syn. Feldspath grenu, *Brard; Haüy;* Weisstein of *Werner ;*)

Is composed entirely of felspar; sometimes aggregated in minute laminæ, in which case it is susceptible of a mechanical division, parallel to the laminæ; sometimes possessing a finely grained structure, and in such case exhibiting a conchoidal fracture; its colour is a pale yellowish red; it is inferior in hardness to quartz; adheres to the tongue, and exhales an argillaceous odour.

Localities.—It covers some portion of a granitic country about Wellington, and in the vale of the Clywd, and is also found on the summit of Flinder's Island. In Van Diemen's Land, it appears first between Mount Cameron and Waterhouse Point, and is next to be met with on the Black range. It is also found on the St. George's and Scamander rivers, to the north of St. Patrick and of Ben Nevis, and to the south of St. Valentine's Peak (Hampshire Hills).

Remarks.—This rock is seldom seen composing alone a tract of country. It is associated with granite; and frequently forms very large masses and veins conjoined with that rock, as is the case in the vale of Clywd, New South Wales.

SERPENTINE.

Colour, sometimes emerald, sometimes leek green, but never uniform throughout; the mass displaying in small spots, irised hues. Externally, it often shines with a waxy or resinous lustre: at the edges, it is translucent. It is found in masses composing a cluster of mountains in Van Diemen's Land, known under the name of Asbestos Hills. It feels unctuous: the streak is generally of the same hue as the rock, though sometimes varying from a brighter to a duller shade. It is solid, semi-hard, and brittle: the fracture earthy, uneven, sometimes laminated; the fragments irregular and splintery. It is traversed by short, curved, and narrow veins of a white, silky amianthus, the fibres of which are perpendicular to the direction of the vein. It does not affect the magnetic needle.

Localities. — In New South Wales, serpentine is found N.E. of Port Stephen, between Bathurst and Molong, and at a locality named Spring Hill; but the largest developement of this rock is in the range which lies between the Coodradigbee and Doomut rivers. It there presents beautiful specimens, approaching the character of precious serpentine, and containing fibrous talc and small fibres of amianthus. In Van Diemen's Land, the Asbestos Hills are the only locality where serpentine is seen in a mountainous mass. On the west side of those hills, it is associated with mica schist; on the east, with limestone; on the north, with greenstone. The maximum height at which it is found is 1500 feet: its structure is decidedly amorphous: but in the vicinity of the river Rubicon, it shows some slight appearances of stratification.

SEDIMENTARY ROCKS.

Mica Schist.

The difference in the colour of quartz and mica, and the varying proportions in which those minerals are aggregated, impart to mica slate an infinite variety of hues, including shades of green, white, red, blue, brown, and yellow. Its structure is distinctly slaty, yielding to the nail, and easily separating in thin layers. Sometimes the minute laminæ of mica render it more compact, when its slaty structure becomes indistinct, and the fracture splintery, and often conchoidal: in this case it appears to the naked eye homogeneous, and resembles flinty slate. It is mostly vertical and contorted; closely fitting the waving lines of the crystalline base upon which it rests.

Localities.—In New South Wales, its range is very limited: on the eastern side of the mountains, it seems abraded; on the western, much broken and contorted. As far as I was able to ascertain, mica slate in New South Wales is only to be met with on Mount Kosciuszko and Mount Pinabar (Australian Alps).

In Van Diemen's Land, it is found between Point Eddystone and Mount Cameron; Piper's River and Miller's Bluff; Port Sorrel and Asbestos Hills; on the rivers Mersey and Forth, Rocky Cape, Black River, and Cape Grimm.

Remarks.—The varieties of mica slate found in the two colonies have in a great measure resulted from the different circumstances under which the slates came in contact with the crystalline rocks. On Ben Lomond, mica slate was reduced to exfoliation, whenever it came into contact with greenstone. The same effect is observed in the mica slate of Piper's and the

Mersey rivers. Its strata are in most cases vertical. It is associated with granite (Mount Cameron); with sienite (Mount Kosciuszko, Mount Pinnabar, and Point Eddystone); with serpentine (Asbestos Hills); with quartz rock (Frenchman's Cap and the western dividing range); and with diabase (Lake River, Scrubby Den).

SILICEOUS SLATE

Is most usually grey, though sometimes white, reddish, or yellowish: it is also opaque; but in a few instances translucent at the edges. The fracture in small specimens is a little conchoidal. The mineral is traversed by numerous veins of quartz, looks greasy, and is tough.

Localities. — In New South Wales it is found at Munmurin Brook, Dart Brook, the River Karua, Booral, St. Patrick's Plains, Vale of Clywd, Fish River, Campbell River, Molong, Wellington, Gidley East, Ajimatong, and on Manes Range.

In Van Diemen's Land, on St. George's River, Mount Cameron, Little Forrester River, Patcham, Hampshire Hills, Emu Bay, Rocky Cape, Montague River, Cape Grimm, the Eldon Range, and River King.

Remarks.—The strata of siliceous slate occur for the most part in a vertical position; at times, however, especially in flat or but slightly elevated countries, it is found very nearly horizontal, as on the river Karua. When in contact with crystalline rocks, it is seen usually associated with sienite, eurite, quartz rock, diabase, and porphyry. When in contact with slates, it rests on mica slate, and alternates with argillaceous slate. Its masses display distinct stratifications, composed of seams half an inch in thickness.

ARGILLITE, syn. COMMON ARGILLACEOUS SLATE (*Kirwan*); CLAY-SLATE (*Jameson*); SHISTE ARGILLEUX (*Bronchant*).

Colour a greyish black, with a bright silky lustre; substance opaque, with a smooth surface; adheres to the tongue, and yields a strong argillaceous odour: the streak is greyish; the structure foliated, the foliæ separating easily. The fragments are tabular, thin, shining, and friable.

Localities. — In New South Wales it is found about the Upper Hunter, the Vale of Clywd, the west of Mount King George, Badger's Brush, the western side of the dividing range, the north side of Argyleshire, Lake George, Gidley East, Long Swamp, Bango Range, at the Murrumbidgee River, Mount Kosciuszko, Pinnabar, Lake Omeo, Thompson's River, and in Gipps Land, on its N.W. and S.W. extremities.

In Van Diemen's Land, between Piper's River and George-town, where it is associated with mica slate and siliceous slate. Its strata here are nearly perpendicular; it extends uninterruptedly for about four miles in a southerly direction; crops out again about Miller's Bluff, associated with the same rocks, and finally disappears with them. The second locality at which it is found is Emu Bay East, where it is seen alternating with siliceous slate. Its strata here also are nearly vertical, and strike in the same direction as those of the former locality: it sinks however under the basalt of Hampshire Hills; reappearing at the foot of Mount Arrowsmith, (between Lake St. Clair and Frenchman's Cap,) where it is associated with mica slate, both lying in a vertical position. Has the appearance of roofing slate, and has often been mistaken for it in Van Diemen's Land; but the presence of mica, and its avidity for water, render it unfit for roofing.

General Remarks upon the First Epoch.

An examination of the evidences which prove the eruption of the crystalline rocks, shows that there were various degrees of intensity with which the expansive forces acted during that eruption. From the unequal heights which, under these circumstances, the crystalline rocks naturally assumed, results a want of uniformity in the inclination of the uplifted stratified crust, and a difficulty in assigning any prevalent dip to the sedimentary rocks.

Thus, at the highest point of elevation, Mount Kosciuszko (6500 feet), mica slate, and siliceous and argillaceous slates are vertical, and attain the height of 3200 feet; which is the case also on the western side of the dividing range, between Lake St. Clair and Frenchman's Cap (Van Diemen's Land). About the Trafalgar River, where the granitic floor has an elevation of only 1400 feet, siliceous slate has a dip of 45°. At Manes Range, between the rivers Murray and Murrumbidgee, the upheaved strata are nearly horizontal.

The best sections of the stratified masses (on the dividing range, Van Diemen's Land), between Lake St. Clair and Frenchman's Cap, also on Eldon Range and Ben Lomond, tend to prove that, of the stratified rocks, mica slate, being the nearest to the crystalline rocks, and following all the contortions of the base, forms the oldest portion of the crust, and that siliceous and argillaceous slates, which rest upon it, are the next in order of superposition.

Which, among the crystalline masses, claims a priority over the rest in point of age, cannot be ascertained with any certainty. The geological evidences that exist in New South Wales and Van Diemen's Land, (Vale of Clwyd, Bathurst, Mount Kosciuszko, Lake Omeo, Ben Lomond, and the Western Range,) seem to prove that the incandescent granitic matter was the first to appear after the breach of the submarine crust; that it was on the granitic talus, that quartz rock and sienite forced their way to the surface; and that, upon the latter rocks, serpentine, porphyry, and greenstone made their appearance. Thus, about Bathurst, quartz rock overlaps granite; and on the Honeysuckle Range, porphyry overlaps sienite; on Mount Kosciuszko, S. W., granite is seen forming a base 2000 feet above the level of the sea, upon which sienite and quartz rock attain a further elevation of 4500 feet. Again, in Van Diemen's Land, sienite rests upon granite, and greenstone upon sienite. In the dividing range, between Lake St. Clair and Frenchman's Cap, the base is granitic up to the elevation of 1800 feet, upon which base quartz rock, massive such as has been described, rises in towering masses to 3200 feet more.

The fact of an alteration of the stratified rocks in contact with the crystalline masses, having in some instances taken place, is obvious in the region here described, though it cannot be as yet satisfactorily traced to its proper cause. Mica slate at times has its two ingredients, quartz and mica, perfectly and widely separated, exhibiting an irregular, nodular aggregation; at other times their intermixture is perfect and laminated: in both cases mica slate appears in contact with granite. The arenaceous sedimentary rock likewise presents a fused and homogeneous mass of granular quartz rock, in which the naked eye distinguishes the grains, although the interstices are obliterated. Such rock is also sometimes found in contact with porphyries, though at other times it is widely separated from any kind of igneous rock.

The extent which the stratified rocks occupy in the two colonies is trifling. They are confined to a small zone, and have been much abraded, to furnish materials for the formation of subsequent rocks.

The crystalline masses may be said to form almost all that tract of the two colonies which is coloured pink in the annexed map, and may, throughout, be described as rising to higher level than the sedimentary rocks. Amongst the former, granite, sienite, and quartz rock preponderate. The first-named rock constitutes nearly the entire floor of the western portion of New South Wales, to the *entire exclusion of mica slate and gneiss*, and extends far into the interior of New Holland, in masses of mammillary, tuberous, globular, or botryoidal form.

In many instances, these masses possess a character analogous to that which the same rock assumes in Central Asia, and sometimes, as is the case in the tract of country lying N. E. of Wellington Valley, between the estate of Guantewang and that of Mr. Montefiore, they present so striking a resemblance to the granitic masses found in the environs of Altai, that the graphic description of that locality furnished by Humboldt may serve to delineate also the above-mentioned region of New South Wales.

" Nulle part, dans l'un et dans l'autre hémisphère, je n'ai vu des granites qui offrent plus le caractère des roches d'éruption ou d'épanchement que les granites qui entourent le massif de l'Altaï. Ces roches, isolées, comme le seraient des porphyres ou des basaltes, sont dépourvu de gneiss et de mica shiste. — Elles s'élevent dans la steppe au pied des montagnes Alpines, sous les formes le plus bizarres. Lorsque de la steppe de Platovsk, où on commence à distinguer à l'orizon les neiges des Alpes Tigirezk, on monte vers les bords rocheux du Lac de Kolyvan, on est frappé de ces *éruptions* de granite, qui, sur plusieurs lieux carrées sortent d'un sol entièrement uni. Les

rochers sont tantôt alignés, tantôt dispersés dans la plaine, affectant les formes les plus bizarres de mures étroits, des tourelles ou des polygones. — Les buttes les plus petites ressemblent à des tribunes, à des siéges, ou à des monuments funéraires. — Ce qui donne surtout une phisiognomie étrange à cette contrée, c'est le contraste de hauteur et de volume des masses granitiques. — Les unes ont quatre à cinq cent pieds d'élévation, comme la *Vysokaïa Gora ;* les autres atteignent à peine sept ou huit pieds d'élévation, et rappellent les petites soulèvements volcaniques qui hérissent ces plaines, que dans l'Amérique espagnole on designe sous le nom de *Mal-pays.* Arrivé au village de Sauchkina ou Sauchka, nous nous trouvames comme au centre de ces éruptions.

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" D'autres formes plus extraordinaires encore se présentent dans les rochers granitiques qui se sont soulevés le long de la pente méridionale de l'Altaï, entre Boukhtarminsk, Narym et le poste Chinois de Baty. Ce sont ou des cloches et des hémisphères aplatis, ou des cônes placés au milieu de la plaine du Haut-Irtyche, cônes terminés le plus souvent par des épanchements latéraux en forme de murs très bas et très allongés. On dirait d'une coulée, effet de la fluidité de la matière sortie sur une crevasse."

Asie Centrale, vol. i. p. 297.

SECOND EPOCH.

The rocks of this epoch, represented by the yellow colouring in the annexed map, are characterized by a group of different crystalline and sedimentary compounds, resting incumbent upon those just described, and which in Terra Australis contain the first record of organic life.

Amongst the unstratified rocks are found quartzose, petrosilex, feldspathic, and claystone porphyries, granular quartz rock, columnar, shistose and amorphous greenstone, serpentine, basalt, trachyte, siliceous breccia, compact, massive, and foliated granular limestone.

Among the stratified masses are siliceous and argillaceous slates, grauwakes, grits, pudding-stones, and conglomerates.

We will select the most important localities illustrative of this epoch, and begin with the north-east of New South Wales.

1st. *Port Stephens.* — Throughout the tract of country which lies between Port Hunter, Port Stephens, and Mount Wingen, the sedimentary rocks of this epoch are found widely separated; each detached portion having its own strike or dip. In this dislocated structure some evidences are nevertheless discovered by which their former continuity may be traced.

Nearly midway between the river Karua and Raymond Terrace there is a very slight elevation or low ridge of siliceous breccia and greywacke, ranging east and west. On both sides of it the country is overspread with a coarse arenaceous deposit, no natural sections of which are found; but a quarry four miles from Raymond Terrace shows that it is composed of two distinct and conformable members, the upper a conglomerate, the lower a friable sandstone, used for building, and containing the following fossils: —

Fenestella internata.
——— *ampla.*
Productus brachythærus.
Terebratula cymbæformis.
——— *hastata.*
Conularia levigata.

The sandstone and the conglomerate are but slightly inclined, and dip to the southward: at Raymond Ferry the conglomerate is found on the left side of the Hunter, almost at the level of its waters.

On passing due westward from Carrington to Booral, we find on a ridge ranging E. and W. a flaggy, greyish-blue argillaceous rock, in strata highly inclined, containing an admixture of calcareous matter and a good many organic remains, some of which, parallel to the laminar surfaces of the rock, are well preserved, and may be referred to

Icthyodorulite,
Littorina filosa,
Turritella tricincta,
Spirifer crebristria,

and the minute genus of Crustacea belonging to Cythere or Bairdia.

A further examination shows that this rock is associated with siliceous breccia and greywacke, which last has greenstone and feldspathic porphyry below. In the immediate vicinity are sandstones and conglomerates, similar to those of Raymond Terrace, at least in a mineralogical point of view; for the absence of natural sections precludes the discovery of the fossils.

At Booral, also, the three members of the group, namely, siliceous breccia, slaty blue argillaceous rock, and sandstone, appear. West of Strout, on the steep banks of the river Karua, four members may be easily traced; the lowermost greywacke, succeeded by a slaty rock, which in turn is succeeded by sandstone and conglomerates, as above described.

In tracing now the greenstone and feldspathic porphyry, which we saw lying below the flaggy argillaceous rock containing *Icthyodorulite*, we see that greenstone and porphyry, about the sources of the river Hunter, is associated with granite belonging to the first epoch; and hence that the above surveyed tract of the country, which for convenience sake we have named Port Stephens, would present the following section in the ascending order: —

	Granite.
	Porphyry.
	Greenstone.
	Siliceous breccia.
Highly inclined	Greywacke. Argillaceous flaggy rock with Icthyodorulite.
Nearly horizontal	Sandstone with Conularia. Conglomerate.

2d. *At St. Patrick's Plains, Glendon, Harper's Hill*, the stratified rocks of this epoch rest upon a siliceous amygdaloid, which abuts against greenstone and basaltic dykes. It is associated with a massive limestone, much broken, and containing —

Platyschisma oculus,
——— *rotundatum*,
Spirifer Darwinii,
——— *subradiatus*,
Pleurotomaria Strzeleckiana,
Fenestella internata,
——— *fossula*.

3d. *The Upper Hunter.* — Here the rocks of the second epoch stretch from the environs of Dart Brook in a western direction, to Gummum Plains and Cassilis. About Coyal it seems to bifurcate to the west. In some parts of this zone, as in Dart Brook gulley, and in the gullies to the westward of Mac Arthur's Peak, the lowest bed is a fragmentary rock, composed of granite, feldspar, mica slate, and argillaceous slate: over this are a sedimentary clay-slate and greywacke, nearly vertical; next above is limestone of two varieties, compact, and foliated granular, in which the traces of organic remains are very indistinct. The whole is crowned by a great development of pudding-stones and conglomerates, in slightly inclined beds.

In some places the described strata are distinctly separated from those of the first epoch by erupted greenstone, as may be seen on the southern flank of Liverpool Range; sometimes they are found abutting against granite and greenstone, as is the case between Coyal and the sources of the River Goulburn.

4th. *At the eastern environs of Cullen Bullen*, the rocks of the second epoch are found stretching partly over the Honeysuckle range, partly over the Wolgan, and jutting out in a neck of land even as far as the western side of Mount King George: they embrace also Mount Victoria, and part of the Vale of Clywd. In this locality we see a fragmentary rock abutting against either greenstone and basalt, or sienite, over which lie clay slate and compact, blackish limestone, in a vertical position, which again are crowned by conglomerates nearly horizontal.

5th. *To the eastward of Lake Barrabura*, in the environs of Glenrock and Barber's Creek, gritstones and fine-grained slaty greywacke form the lowest bed of the group of rocks under consideration; between which and the granitic base we see quartzose porphyries and jasperoid rocks intervening. The compact limestone which comes next above is either in contact with gritstones, or with porphyries; and passes imperceptibly into fossiliferous limestone. At Amprier, and east of Glenrock, the fossils which this limestone presents are greatly obliterated, and for the most part, they are but slightly delineated on the weather-worn surface of the rock. They consist of

Amplexus arundinaceus.
Crinoidal stems, &c.

6th. *Illawara.* — Of the rocks belonging to the second epoch, this locality exhibits but the fossiliferous limestone, which we noticed in the described group of Harper's Hill: — that limestone is found amidst vast dislocations referable to different periods, and containing the following fossils —

Stenopora crinita.
Allorisma curvatum.
Pachydomus antiquatus.
———— *cuneatus.*
———— *lævis.*
———— *globosus.*
———— *carinatus.*
Orthonota costata.
Eurydesma cordata.
Pecten Illawarensis.
Productus brachythærus.
Platyschisma rotundatum.
———— *oculus.*
Pleurotomaria Strzeleckiana.
———— *cancellata.*
Terebratula hastata.
Belerophon micromphalus.
Spirifer Darwinii.
——— *subradiatus.*
Theca lanceolata.
Conularia levigata.

7th. *At Modbury West*, the group of this epoch is seen resting against argillite and granite: its limestone likewise bears only a very indistinct fossiliferous impression.

8th. *South-west of Arthursleigh*, about Greenwich Park, the limestone is associated with greywacke, which is separated by greenstone and serpentine from the granitic basis. In all cases the superstructure is pudding-stone and conglomerates, all in nearly horizontal position; some much worn away; some still overtopping the surrounding country, as is the case six miles S. W. of Arthursleigh, and to the northward about Ballangola.

9th. *To the westward of Lake Barabura and Lake George*, the rocks of the second epoch extend almost in the same order of superposition as we have described in the already noticed localities. Thus, limestone presents itself first as compact and non-fossiliferous, and then gradually becomes a fossiliferous, having for its base either the sedimentary rocks greywacke, clay slates, or siliceous breccia, or quartzose porphyry, greenstone, and basalt. The conglomerates and pudding-stones which are overlaying this limestone, are in a state of partial disintegration, particularly about Yass Plains.

In consequence of this disintegration, the limestone is left exposed. In Wellington Valley, Molong, and Boree, its examination is very interesting, owing to the osseous breccia found in its caverns. On the north of Mount Canoblas and Yass Plains it is likewise so, on account of some fossils more or less perfect: which may be referred to

Favosites Gothlandica,
Crinoidal columns.
Orthoceras,
and *Impressions of Trilobites, not exceeding half an inch.*

In Van Diemen's Land, the localities at which the rocks of the second epoch occur are: —

1st. *Asbestos Hills on the south.* — The lowermost of the series here appears to be a slaty, micaceous, and argillaceous rock, highly inclined, resting upon siliceous amygdaloid and breccia, and at times abutting on a greenstone rock. Next to it is seen a compact limestone, gradually becoming fossiliferous: over this is a conglomerate, in nearly horizontal beds.

2d. *House-top Tier* (Hampshire Hills). — Feldspathic rock, with a slaty cleavage, at times conchoidal in fracture, is here the lowest member, resting either upon granite or feldspathic porphyry; and subjacent to a granular limestone, which is without fossils. (Dr. Milligan.)

3d. *From Emu Bay to Cape Grimm*, extends a continuous tract of siliceous and argillaceous slates, reposing upon several parallel axes in the direction of north and south. The transverse section shows that the strata are contorted and wavy, with a varying inclination. The axes are composed either of granular quartz rock, basalt, greenstone, or a jasperoid rock; the slates are usually gritstones, and fine-grained, siliceous, and argillaceous slates of red, greenish, grey, black, and blue colour. This tract of slates is elevated but few feet above the high-water mark, and is surmounted here and there by horizontal beds of conglomerate.

4th. *Belvoir Valley, Circular Pond Marshes, and the limestone caves of the River Mersey* (Mr. Reid's farm), present similar geological features so far as regards the group of the second epoch. The three localities have for the lowest rock a flaggy gritstone, or granular quartz rock and clay slate, in an inclined position, resting upon quartz rock, feldspathic porphyry, greenstone, and basalt. A compact limestone, pudding-stones, and conglomerates are associated with them: the last is in horizontal beds. No organic remains have as yet been discovered here.

The limestone of the above three localities is much traversed by greenstones and basalts, and exhibits, in the structure of the caverns which it forms, and in the funnel shape which the surface in many places assumes, marks of partial subsidence. (Circular Pond Marshes.)

5th. *Norfolk Plains.* — Here the lowest strata are siliceous breccia, resting on a greenstone base: on these lies gritstone and fragmentary argillaceous rock of slaty structure, in an inclined position. The limestone next above is flaggy, and the beds nearly horizontal: it contains the following fossils:—

Stenopora Tasmaniensis.
Productus brachythærus.
Spirifer subradiatus.
Pecten limæformis.

This limestone is covered by a conglomerate in horizontal beds, visibly indurated by the action of heat.

6th. *Ben Lomond on the N. E., and Ben Nevis on the S.*, show this group in the following ascending succession. First, siliceous breccia, composed of fragments of mica slate, argillaceous and siliceous slate; then greywacke; next, compact claystone; and lastly, compact limestone without fossils: the whole crowned by immense masses of greenstone, which are seen thrust between the members of the group and mica slate, and rising on the granitic base to the height of 5000 feet. In the eruption of the greenstone which constitutes the dentiform crest of Ben Nevis, the lower members of the series (the siliceous breccia and clay slate) were disjoined, and carried to the height of 3200 feet, where they are found lying on the neck which unites Ben Nevis with Ben Lomond.

7th. *Break-o'-Day Valley, East.*—A westerly section from St. Patrick's Head, beginning with the sienitic axis of the chain, furnishes the following members to the series: granular quartz rock, greywacke, gritstone, clay slate, clay stone, and massy and slaty limestone, with the following fossils:—

Stenopora Tasmaniensis.
Fenestella ampla.
——— *internata.*
Spirifer subradiatus.

This limestone is in a few instances overlaid by a conglomerate. The whole group, with the exception of the limestone and conglomerate, is thrown in a very inclined position by the greenstone of St. Patrick's Head, which greenstone burst up between it and the sienitic axis.

8th. *The sources of the river Nive, in the Upper Country, and the locality east of Marlborough*, exhibit perhaps the most complete section of this group that is to be seen. Here a massy fossiliferous limestone abuts against a very inclined argillaceous and siliceous slate: upon this limestone rests a slaty fragmentary rock without fossils; a fossiliferous, arenaceous, and argillaceous massive rock, with somewhat of a slaty fracture, follows. This is crowned by a sedimentary deposit of mud and fine sand, which reaches an elevation of 5200 feet. The series in this locality contains the following fossils: —

Crinoidal columns.
Productus brachythærus.
Spirifer subradiatus, and *S. Stokesii.*
Fenestella internata, and *F. ampla.*

9th. *Eastern Marshes.* — Greywacke with a slaty cleavage forms here a highly inclined base, on which rests a compact massive limestone, containing

Pecten limæformis,
Productus brachythærus,
Fenestella internata, and *F. ampla*,
Spirifer subradiatus, and *S. Stokesii.*

This limestone is covered unconformably by conglomerate, which is much worn away. The eruption of the greenstone which now separates the tributaries of Little Swan Port from those of the Tamar river does not seem to have affected the position of the limestone.

10th. *Mount Dromedary; Mount Wellington; Grass Tree Hill.* — The limestone of this locality is both mineralogically and geologically similar to that of the Eastern Marshes, and the sources of the river Nive: it contains the following fossils: —

Stenopora Tasmaniensis.
——— *ovata.*
Fenestella ampla.
——— *internata.*
——— *fossula.*
Productus brachythærus.
——— *subquadratus.*
Pecten Fittoni.
—— *squamuliferus.*
Spirifer subradiatus.
——— *Tasmaniensis.*
——— *Stokesii.*
——— *avicula.*
——— *vespertilio.*
Pachydomus globosus.

The position of the two fossiliferous members of the group, on the east side of Mount Wellington, above Mr. Hull's house, as also the position of the conglomerate on the top of Mount Wellington, is owing to the eruption of the greenstone of that locality, by which the above-named members of the series were disjoined, and elevated far above the rest.

11th. *Spring Hill, West.*—A fossiliferous greywacke, with

Stenopora informis,
Fenestella ampla,
Pachydomus globosus,
Orthonota compressa,
Pterinea macroptera,

is the only member of the rocks belonging to the second epoch which is found in this locality. Its position relatively to the subjacent strata is difficult to be determined with accuracy, on account of the prevailing dislocations.

12th. *Eagle Hawk Neck.* — The arenaceous and siliceous, flaggy, fossiliferous rock, noticed in the vicinity of the river Nive and Mount Wellington, is here found at low-water mark, in almost horizontal strata. It is laid bare by the action of the sea-water on the superincumbent conglomerate, and exhibits a surface fissured in a series of rectangular squares.

This rock is characterized by the abundance of *Spirifer vespertilio* and *Sp. avicula.*

MINERALOGICAL DESCRIPTION OF ROCKS BELONGING TO THE SECOND EPOCH.

CRYSTALLINE ROCKS.

Porphyries.

The porphyries of the two colonies present five varieties which may be named from the varieties of the homogeneous and compact basis in which the crystals or grains of other mineral are embedded.

Var. 1. *Felspathic Porphyry.*

In the eight localities in which this variety of porphyry occurs, some differences are observable.

On the river Forrester, where the rock pierces through sienite and granite, its colour is greyish; its structure nearly compact; its fracture uneven, and nearly dull: it contains milky crystals of felspar, and highly comminuted grains of mica and hornblende, which latter predominate.

At Waterhouse Point. This porphyry is associated with granite and eurite; its colour is ashy grey, with a faint reddish tinge on the weather side, and a darkish cherry on the inside of the fresh broken. It is compact; fracture conchoidal and dull: it contains grains of limpid quartz, and of flesh red felspar; some of which are rounded, some angular: those of felspar predominate.

To the South of Waterhouse Point, the felspathic porphyry is associated with eurite. Its colour is flesh red; structure nearly compact; fracture foliated; lustre glittering: it contains grains of hornblende scantily disseminated, and of laminar felspar, which predominate.

The vicinity of Mount Cameron.—This rock is observed between granite and granitic porphyry. Its colour is a yellowish red; structure compact; fracture uneven and dull: the embedded minerals are quartz, mica, and felspar; the last predominating.

In the Black Range, where it is associated with granitic porphyry and eurite, this rock is similar to that found to the S. of Watherhouse Point, excepting that it does not contain any crystals of hornblende.

At St. George's River it is found between granitic porphyry and siliceous slate. Colour yellowish; structure compact; fracture conchoidal and glittering Its embedded crystals are limpid quartz and felspar, the last predominating.

At the river Nive (twenty miles north of Marlborough), this rock is associated with granitic porphyry. Its colour is greyish green; structure compact; fracture uneven and shining. It contains grains of limpid quartz, crystals of hornblende, and rounded crystals of finely laminated felspar.

Before the blow-pipe, the paste of this variety melts into a white enamel, compact and translucent, and sometimes containing bubbles.

Remarks.—The most remarkable fact connected with these seven species of porphyry is, that, different as they seem to be, they are to be found *in one current, or rather in one mass of porphyry at Port Stephen, New South Wales.*

Var. 2. *Petrosilex Porphyry.*

Colour brownish black; structure compact; fracture uneven and dull. It contains crystals of felspar and hornblende, with some mica, thòse of hornblende greatly predominating. It resembles the melaphyre of Brongniart, and before the blow-pipe melts sometimes at the edges only into a blackish, porous enamel: is found at Cape Portland, and on the west coast of Van Diemen's Land.

Var. 3. *Quartzose Porphyry.*

In the localities in which this variety of porphyry is found, some difference in its external character is observable.

At Mount Cameron (V.D.L.), where it lies between granite and gneiss, it is of a yellowish colour; structure nearly compact; fracture uneven and at times splintery. It contains grains of limpid quartz, and of felspar minutely comminuted, the grains of quartz predominate.

At Barber's Creek, *Modbury*, *Bango Range*, and between *Derrangullen and Jugion Creek* (N. S. W.); on the *dividing range*, and at *Mount St. Patrick* (in V. D. L.), where it is associated with sienite, its colour is grey; structure very compact; fracture conchoidal, splintery and glittering. The contained crystals are limpid quartz, mica and minute grains of hornblende: the quartz predominating.

On the *river Forth*, the quartzose porphyry is associated with basalt and claystone porphyry: its colour is greenish. It contains crystals or grains of limpid quartz, hornblende, and minutely comminuted mica. Its structure is very compact; fracture splintery, lustre vitreous: the predominant ingredient is quartz.

Before the blow-pipe, the paste of this variety does not melt, except sometimes at the edges only.

Var. 4. *Claystone Porphyry.*

Occurs at two localities, the specimens of which present marked differences in their external character. That of *the river Forth*, east of Western Bluff, is associated with trachyte proper and cellular trachyte. Its colour is dark cherry brown; structure very compact; fracture uneven and splintery. It contains grains of glassy quartz, which predominate in the compound, and possess all the characteristics of the quartzose porphyry of Von Buch.

That of the *Vale of Belvoir* is associated with basalt and compact limestone. Its colour, like the preceding sub-variety is a blackish cherry brown; its structure compact: the paste, however, when examined with a glass, is found to consist of small shining grains in a state of vitrification. The fracture, though splintery, is more even than that of the river Forth: it contains felspar of a dull milky hue, which is sometimes rounded, sometimes angular. Subjected to the blow-pipe it melts at the edges only: that of the last-mentioned locality resists even the heat produced by oxygen gas.

This claystone porphyry occupies a larger extent of country than any of the other varieties; indeed, the whole range which separates the Vale of Belvoir from Mayday Plains is composed of the Belvoir porphyry, while that of the river Forth stretches on the eastern side of Western Bluff, towards the Eldon range.

Var. 5. *Mimophyre.*

This variety of porphyry is composed of grains of felspar, quartz, and at times of mica, embedded in an argillaceous cement. It occurs in New South Wales, south of Lake Burraburra, and on the banks of Mitta-mitta River. It passes into psephite, an argillaceous and sandy paste, which cements grains or fragments of mica slate, argillite, and quartz, irregularly interspersed.

Remarks. — Every where in the vicinity of the five above varieties of porphyries, phenomena of disturbance and disorder are perceptible, impressing the mind with an idea of that high degree of force and violence, by which they had been injected between the stratified and unstratified rocks. The porphyry of the river Nive, twenty miles north of Marlborough, seems to have exerted a greater chemical power than any of the others, having transformed a sedimentary rock of non-fossiliferous greywacke into a mass of porphyritic structure, and burst through the fossiliferous greywacke, and covered it with breccia, composed of fragments of quartz rock and mica slate. The porphyry of the river Forth is scarcely less remarkable for the extensive changes which its intrusion effected, or rather, which immediately after that intrusion were worked out. These two kinds of porphyry, as well as the others here noticed, when propelled from beneath, so convulsed, tore, and shattered the superincumbent rocks, that the crust thus loosened and weakened, became as it were a beaten track prepared for the subsequent intrusion of greenstone, basalt, and trachyte. Indeed the porphyritic ejections have given such facilities for the intrusion of other igneous rocks, that it is almost always from the vicinity of their eruption that greenstone, basalt, and trachyte appear to have spread, and now cover immense tracts of the country.

GREENSTONE.

DIABASE (*Brongniart*). DIORITE (*Haüy*).

The varieties of this kind of rock, belonging to the second epoch, are uniformly composed of felspar and hornblende in the state of grains or of small crystals, in proportions somewhat different, but in which the hornblende constantly predominates. They vary also in their structure, which is either slaty, prismatic, or amorphous; as, however, that structure has been the result of peculiar agencies, acting evidently at very different geological epochs, their description and examination is given here separately.

Var. 1. *Slaty Greenstone, Diabase schistoide.*

Its invariable colour in the recent fracture, is between a leek and pistachio green; that of the exterior of the rock is reddish brown. The internal surface has a waxy lustre; the imbedded crystals of hornblende are generally brilliant.

Its structure is schistose, but the layers are never parallel; and are running from a thickness of two or three inches to a wedge-like termination. For the most part, these seams present a lenticular form resembling convex lenses closely fitting, and thus beautifully illustrating the successive overflowings of the incandescent matter. It does not adhere to the tongue, and exhales an argillaceous odour. The streak varies; the powder obtained by trituration is of a brownish yellow colour. The structure is compact and hard; the blow of the hammer on the mass merely detaches layers which exhibit surfaces of their own. The shape of the fragments is commonly tabular.

Localities. — It is found at Booral on the Upper Hunter in Argyleshire, and about Lake George. Its greatest extent occurs in the locality of the Upper Hunter, on the Liverpool Range, of which it forms the culminant point.

In Van Diemen's Land, it is found in every part of the island. The localities which supply the most important facts bearing upon its geological relation are between Launceston and Mount Direction; Mount Direction and George Town; George Town and Stony Head; Cape Portland, St. Patrick's Head; between the Break-o'-Day River and the Tyne; Ben Lomond, Ben Nevis, Port Sorrel, Dry's Bluff, Lake Arthur, Lake Sorrel, the Great Lake, Lake St. Clair, Western Bluff, Mount Cradle; the source of the Nive and Mount Cameron West.

Remarks. — This variety of greenstone occurs at various heights above the sea and the shore, capping some of the most prominent elevations of the interior of the island. The greatest height which this greenstone attains is 5200 feet. It is invariably and intimately associated with porphyries, argillaceous schist, mica slate, sienite, granite, silicious slate, and limestone; when it is isolated from the prismatic or amorphous greenstone, its seams are horizontal. When, however, these varieties are in contact with it, the seams are vertical, broken, and distorted.

The examination of the great area which this schistose greenstone covers in Van Diemen's Land, leads to the discovery of sources from which it overflowed the island. The principal sites appear to have existed in the vicinity of Cape Portland; between Mount Barrow and Mount Arthur; on the north side of Ben Lomond, on Mount St. Patrick, at Port Sorrel, on Mount Cradle, Mount Cameron West; and at the source of the Nive.

In all these places, the schistose greenstone is associated with porphyries. This association of the two rocks strongly inclines me to believe that the slaty greenstone was erupted or propelled along the pre-existing side or slope of the consolidated porphyry.

Var. 2. *Prismatic Greenstone.*

Its colour in the recent fracture is blackish green; on the surface, yellowish brown. The lustre of the paste is waxy; that of the hornblende which it contains vitreous; it does not adhere to the tongue, and exhales an argillaceous odour; its streak is dissimilar and dull; its colour a brownish grey; when struck with the hammer, it gives a metallic sound: it is compact, hard, its fracture is somewhat conchoidal. The structure is prismatic, the prisms having three, four, five, six, or seven sides. Their diameter varies from three to eight feet; the length of two or three columns, which are still entire, exceeds 100 feet. The clustered columns are sometimes very closely united; sometimes they are only in close contact, and are separated by the fall of the masses. Some of the columns have but a slight influence upon the magnetic needle; and in these the axes range east and west. The columns lying parallel with the meridian, or nearly so, disclose a strong polarity; a phenomenon worth noting, as the property seems to be more dependent on the bearings of the axes of these columns than on their constituents. The discovery of this polarity was consequent upon the anomalous results which the observations of the magnetic intensity furnished me by the prismatic greenstone on Ben Lomond.

Var. 3. *Amorphous Greenstone.*

Its colour is like that of the preceding varieties, the fracture displaying sometimes a blackish green, sometimes a leek green; the exterior is invariably a yellowish brown.

Its paste has a waxy lustre. Its structure is amorphous; the fracture is somewhat splintery and uneven; the shape of the fragments irregular. It has a dull sound when struck with the hammer.

Localities. — In New South Wales, this rock is found west of Port Stephen; also in the Liverpool and Honey-suckle Range, at Modbury and in Argyleshire. In Van Diemen's Land, it is distributed widely over the island; the principal localites are between Launceston, Mount Direction, and George Town, at Cape Portland, on Ben Lomond, at the junction of the North Esk with Ben Lomond Creek, between Quamby's and Port Sorrel, at Dry's Bluff, Miller's Bluff, Scrubby Den, Lake Arthur; between Lake Arthur and the Great Lake, at Lake St. Clair, on Eldon Range, Mount Cradle, Barn Bluff, Mount Roland, Mount Wellington, Tasman's Peninsula, Research Bay, Adamson's Peak, Bruin, Green Island (Bass's Straits), and Woolnorth, Cape Grimm, and Mount Cameron, West.

Basalt, Lava, and Trachyte.

From my own observations made among the volcanos of Europe, Mexico, and South America, and more particularly in the tremendous volcanic laboratory of Kirauea in the Sandwich Islands, I am inclined to believe that there will be found insuperable difficulties in the way of a classification of volcanic products.

In many instances, the existing subdivision of volcanic rocks into varieties is but imaginary — the distinctions referring rather to individual specimens than to the mass from which they were taken. Thus the three varieties into which basalt has been subdivided, and each of which is characterised by the preponderance either of labradorite, of orthoze, or of albite, have been found by the writer in one current of basalt (at Kirauea), within an area of four cubic feet; some splinters of these being soluble in hydrochloric acid, while others were not.

Again, the four varieties of lava, distinguished by Dolomieu and others into granitoïte, porphyritic, micaceous, and hornblende trachyte, with still other varieties, is inadmissible from the fact that these varieties at times constitute a part of the continuous mass of rock, with such gradual transition, that it is impossible to assign the boundary where the one variety begins and the other terminates.

In illustration of this subject, I shall give here a brief description of the volcano of Kirauea, extracted from my manuscript notes.

"The volcano of Kirauea lies on the north-western side of Mouna Loa, about twenty miles from the summit of that mountain, and about forty from the Bay of Hilo: its latitude, determined on the spot, is 19° 27′. Its present size surpasses that of every other known volcano, yet it now hardly displays more than a third of its pristine grandeur. Like some of the old Egyptian cities, Kirauea has no other chronicles of the past than a part of its ancient walls still standing, and a part either in ruins, or buried at some period beyond the memory of man, under the ashes of successive eruptions, though still to be recognised and traced by means of the masses which stand at intervals as land-marks.

"When, pencil in hand, we take the circuit of these land-marks,—collect, as it were, the scattered materials, fill up the breaches, and thus reconstruct the former orifice of the crater,—we are thrilled with awe at the contemplation.

"Fearful and astonishing must have been the action of this volcano in the days of its former greatness,—when it belched its fires from a mouth twenty-four miles in circumference, and overwhelmed the country with its devouring floods. But as all power bears within itself the seeds of its own destruction, so Kirauea, irresistible on every side, has ended its career by breaking down the bounds which contained it. The south-south-western walls, of which the exterior declivity is very steep, gave way the first; but those to the north and N. N. E., supported outside by the congealed volcanic masses which had previously burst their bounds, and flowed in confusion to a distance of forty miles, have stood firm; and, like precious monuments of history, form an interesting subject for the traveller's investigation.

"The highest point of these ruins was determined by repeated observation to be 5054 feet above the level of the sea. They resemble the outer edge of a cup, to which a portion of the overflowing matter still adheres; and show that the crater, just before being emptied, was brim-full of molten lava. This vast mass of igneous matter must, however, have been the result of long accumulation: the ancient walls to which I refer, show, by layers of carbonaceous and earthy matter interposed between those of volcanic origin, that they were respectively produced at distant intervals, during which there must have been a variation in the intensity of the heat, and in the concomitant circumstances. Frequently, a layer of blocks of lava, compact, fine grained, and united, follows one of volcanic ashes and earthy substances, similar to *tufa*, or rather to *peperino;* which, in its turn, had succeeded to one of porous lava. One layer is found to affect the magnet, another not; in some cases, the porous cavities contain crystals of laminar or ligniform talc; in others, augite, olivine, and shorl are found throughout the whole length and thickness of the bed. It would even appear, judging from a specimen which I discovered in a cleft of the ancient crater, that the same mass must have been ejected, and again undergone the action of other still more powerful fires, by which its surface has been altered, so that the interior of the mass exhibits argillaceous substances, petro-silex, and crystals of hornblende; while the exterior, which formed part of the wall of the crater, has been vitrified and cracked, displaying in its crevices sulphur and muriate of ammonia.

"The interior and lower part of the emptied basin, as it now appears, offers interesting matter for investigation. Its vast platforms, often arrayed in terraces levelled by deposits of cinders and volcanic dust, solid in appearance though actually friable, are intersected by clefts, emitting hot clouds of watery vapour, which escape with considerable force, and with a sharp whistling noise like that of the valves of a steam engine. The character of these clefts appears to be uniform. The temperature of the vapour is variable: one cleft will give 156° at the depth of a foot from the opening, while another, a few paces off, will not give more than 140°.

"Even here, on these arid heights, burnt and dried up, desolate to the eye and depressing to the spirits, Nature, as if with a benevolent regard to those who come to behold her wonders, has caused a Decandria to spring up around one of these clefts to the height of three feet, so as to intercept the escaping vapours, and to help to condense them; the precious liquid, thus protected from evaporation, was found to be delicious water, offering, in a waste of thirty miles in extent, and destitute of moisture, a basin, ever full, ever fresh, ever ready to moisten the parched lips of the wanderer.

"At two hundred paces from the welcome reservoir is the sunken furnace of Kirauea, reduced from its former grandeur to eight miles of circumference, and presenting one of the sublimest scenes of nature, the interest inspired by which can only, perhaps, be rivalled by the awe which they impress.

"It is no small effort to recall the attention from the vague contemplation of that scene to the calm investigation of facts and phenomena before us.

"The point at which I computed the height above the level of the sea is on the N. N. E. of the crater: its height is 4109 feet, which is at least 950 feet below the brim of the ancient crater: and within two paces of this spot is the edge of the precipice, which falls perpendicularly 600 feet lower to the boiling surface of igneous matter.

"The descent to this level is often precipitous, and winds among a thousand openings which vomit forth hot vapours from an area thickly strewed with tabular masses of smoking lava. Like the ice in a blocked-up channel, these tabular masses remain either standing on end, or heaped in horizontal or half-raised beds, and gaping with fissures over fearful cavities, resounding with noises similar to those of a roaring stormy sea.

"Six of these cavities were in violent agitation while I was exploring the crater: the height of the banks which bounded them varied; four were not more than three or four feet high; the fifth, forty feet; the sixth, 150. The extent of their surface differed no less; the first five hardly contained 12,000 square feet each, while the sixth contained nearly a million. The surface of the fiery matter in all the six reservoirs kept at the same height,—rose, sank, and was agitated simultaneously; which seems to show that it belonged to one mass of liquid lava, filling the whole area of the interior of the crater, and that the cavities, or reservoirs, as I have called them, are mere openings, and the heaps of broken lava, which block part of the crater, a mere temporary covering, or bridges, as it were, over the formidable mass below.

"No pen or pencil could adequately describe the stupendous grandeur of that ceaseless impetuosity and fury of the incandescent matter which is produced in these reservoirs by the violence and the intensity of heat; or of those fierce and glowing waves which, continuing to beat and splash against the walls of the reservoirs, produce a floating froth spun out by currents of air, in a form of capillary glass, similar to that of a floating gossamer.*

"The examination of these reservoirs is beset with danger: besides the suffocating fumes of sulphuric acid gas, the inhalation of which may prove fatal, there is a risk of falling into the fiery matter, which is every where below the superficial crust. Seldom does it confine itself to the reservoirs; often appearing unexpectedly through the cracks of the black and rugged lava over which the path lies, assuming the same outward appearance by rapid congelation, and moving almost imperceptibly in slow convolutions, twisted like a thick fluid when compressed by a porous covering. The danger is much increased by the character of the lava which this volcano produces. Information received from Sir George Mackenzie, the well-known explorer of Hecla, leads me to believe that this lava of Kirauea is a species of that kind known under the name of "cavernous," which by the intensity of its heat, and the abundance of its elastic gases, produces here, as in Iceland, tumefactions, varying from the thickness and delicacy of a soap-bubble to the size of caverns twenty or thirty feet wide. These caverns, which extend in every direction, form beneath the surface of the island subterranean channels, through which the overflowing lava makes its way; and are often covered by a hollow arch, which yields at once to the tread; so that I had frequently the misfortune of falling into them, in spite of all my precautions. Their interior furnishes for examination the most interesting incrustations of sublimed minerals, with crystalline forms, the perfection of which can hardly be appreciated without a microscope, and so delicate as scarcely to bear a breath.*

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* Even in the breasts of the natives the magical influence of this spot has not been unfelt; they approach it with a sacred awe, and offer their religious adoration. And this is natural. In the contemplation of the disasters which the eruptions of the lava have spread over the plains, and of the calamities which have consequently overtaken the inhabitants, man, in his primitive state, can only see his littleness, his nothingness,—he can only feel the presence of an invincible and angry power, whom he must appease and render propitious. The divinity called *Pelé*, supposed to reign as the Neptune of these fiery floods, receives their adoration, and has her priestesses and her sacrifices; nor can any ceremony of antiquity have been more striking than that of the Sandwich Islanders in their sacrifice of men and swine to the burning gulph. To the largest of the six reservoirs, called *Hau-mau-mau*, by the natives, the terrified people make their way with prayers and offerings: into its gulf also they consign the bones of high priests, distinguished chiefs, and of those who have deserved well of their country.

"On the western flank of the crater above described, the appearances render it probable that the former surface of the incandescent matter was 300 feet higher up than it is at present; and that the opening of the crater of Mouna Roa, which is now 8000 feet above, diverted the course of the intense subterranean heat from the crater of Kirauea, or at least lowered its intensity. A probability further exists, that the incandescent matter of the interior of the crater became refrigerated and solidified in the mighty cauldron; and that after a lapse of time the base on which it stood gave way, under the renewed agency of subterranean heat, when the mass cracked and slipped. It seems also that a large mass of the solidified lava must have fallen again into the abyss, to be there re-molten; while a part still remained lodged against the sides of the cauldron, and is now seen as a rock 200 feet in height, exhibiting basalt, trachyte, and lava of several varieties. *Between the scoriaceous lava, approaching to slag, which is uppermost, and the close-grained basalt, which forms the lowest portion of the rock, the transition is so gradual, that it is impossible to assign the spot where basalt ceases and trachyte or lava begins.*"

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* On the southern plane of the crater are deposited mounds of sulphur, more extensive than those of Solfaterra, in which the following mineral substances are found crystallised :— two varieties of the sulphuret of arsenic; the petro-alumine of tolfa and sulphate of alumine; and the ten secondary forms of the primitive octahedron of sulphur.

The enlightened Von Buch has remarked*, and Dufresnoy and Elie de Beaumont have confirmed the observation, that the word *lava* is an expression which relates only to the form. The facts collected in the crater of Kirauea would lead one to suppose that the words basalt, trachyte and lava, serve only to distinguish the upper from the lower part of a molten matter. It is probable also that the distinction of basalt into *columnar* and *amorphous* refers only to their relative form, and that both rocks belong to the same basaltic current, and most likely resulted from the angle of inclination of the plane or surface which that current has overflowed.

Thus, on the road from the heads of Cowrang Creek (New South Wales) to Lake Omeo, there is a basaltic, horizontal dyke, running from south to north. At the left bank of the river Mitta-Mitta, which bank is about 100 feet high, that dyke is seen precipitating itself downwards into the river, and thus appears like a frozen or petrified cascade. The dyke *throughout its horizontal course presents an amorphous form; in its downward fall it assumes insensibly the form of columnar concretions, till it reaches the bottom of Mitta-Mitta, where it exhibits three, four, six, and seven-sided regular prisms, not exceeding three inches in diameter.*

The localities at which basalt and its varieties occur in the two colonies, are the following:—Port Stephens, the Lower and Upper Hunter, Mount Tomah, Mount Hay, Mount King George, between Bathurst and Boree; Frederic Valley, Mount Canoblas, between Molong and Wellington Valley; on the Razor Back range, at Illawara; on the crest of the Mitagong range, at Lake George, Shoalhaven, Dutzton at Lake Omeo, and the river Mitta-Mitta, (*New South Wales*). Kent's Group, Green and Swan islands, (*Bass Straits.*) Between George Town and Stony Head; at the Gardens; Ben Lomond; Vale of Belvoir; between Gadd's Hill and Middlesex Plains; Hampshire Hills; the Duck river; the Welcome river; Cape Grimm; Mount Cameron West; at Arthur's Lake; and the source of the river Nive; at Lake St. Clair; on Mount Cradle; between Brighton and Bridgewater; Mount Wellington; Hobart Town; Research Bay; Esperance Harbour; Bruni's Island, and Tasman's Peninsula; (*Van Diemen's Land*).

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* In describing the tract between Lake Orta and Lake Lugano.

BRECCIAS.

These rocks present two varieties: the first consisting of aggregated fragments, which preserve the character of the rocks from which they are derived; while in the second this character is entirely effaced, both the paste and the fragments passing through different stages of change, and assume at last the appearance of uniform pitchstone or jasperoid rocks.

First Variety.—An aggregate of unaltered mica slate, argillite, quartz rock, and felspar. The predominant colour is usually a shade of ash-grey. The cement seems to be composed of the same materials as the fragments, but consists of grains so minute that it resembles a homogeneous paste.

The *Second Variety* of breccia presents the appearance of a semi-fused compound of variegated colour. Its lustre is resinous; it is translucent at the edges;

compact, and extremely hard; having sometimes a splintery, sometimes a conchoidal fracture. This variety is frequently amygdaloidal, and though different in external character from the first variety, leaves no doubt that both were originally identical. They generally occur together, amongst rocks of the first or second epoch, in large masses. In New South Wales, the second variety is observed only at St. Patrick's Plains, Wellington Valley, and Lake George. In Van Diemen's Land, the two varieties crest the ridge which connects Ben Lomond and Ben Nevis, an elevation of 3200 feet; the first variety, incumbent on mica slate, quartz rock, argillite, and granite, is superposed by the second, which is connected with hornblende rocks. It occurs also at Waterhouse Point, between the river Tamar and Mersey, at Table Cape, Hampshire Hills; in the Vale of Belvoir; Dry's Bluff, Lake Mills river; in all the above localities the breccias are associated with eurite, quartz rock, and clay slates.

LIMESTONES.

Var. 1. *Foliated granular Limestone.* (Jameson.)
Chaux carbonaté saccaroide. (Brongniart.)

That variety presents itself in different shades, from black to snow-white: these shades are sometimes uniform in the mass; sometimes they occur in spots, veins, or clouds of different hues. Its structure is both foliated and granular: in some cases the grains are only discernible by means of a lens. It is generally a pure carbonate of lime, and very seldom with admixture of foreign ingredients. In two localities only, it contains crystals of hornblende and shorl.

Localities.—In New South Wales granular limestone is extensively developed. It is found on the

Upper and Lower Hunter, between Wellington and Mount Canoblas; between Cullen-bullen and Wolerowang; on the Wollondilly; in Westmoreland; on the Shoalhaven river, between Amprier and Barber's Creek; at Lake George, Yass Plains, and Murrumbidgee; on the Murray and on the river Thompson (Gipps Land). In Van Diemen's Land, it is found south-east of Mount Horror; on Asbestos Hills; at Circular Pond marshes, Belvoir Vale, House Top Tier, and the sources of the river Nive.

Some parts of New South Wales can boast of most beautiful marbles, very valuable for statuary and other ornamental purposes; as on the Wollondilly, where the rock is as closely grained and as white as the Carrara marble; and at Amprier, Shoalhaven, where the stone is a jet black traversed by veins of a white calcareous spar: between Wellington Valley and Boree there are also innumerable varieties of finely variegated marbles, in which caves are found of the greatest interest to geology. The most remarkable in New South Wales are those in the neighbourhood of Wellington, Boree, Shoalhaven, and Murrumbidgee. In Van Diemen's Land such caves are limited to the river Mersey, and to Circular Pond marshes. The latter locality deserves to be noticed, as the funnel-like shape of its surface, combined with the form of the caves, would lead to the belief that the limestone tract has undergone partial subsidencies.

Var. 2. *Compact Limestone.* (Kirwan.)
Common compact Limestone. (Jameson.)

Is in colour as variable as the preceding variety: in the greater number of localities the ash-grey tint predominates. It is at times massive, at times has a somewhat stratified appearance. It is not a pure carbonate, but contains many foreign ingredients, and passes into the earthy variety of limestone. It resembles very closely the preceding variety, and in most cases, like the limestone of Boree, is intimately associated with it. It is this variety that contains the marine remains which have been already enumerated.

Localities.—In New South Wales this limestone is found at St. Patrick's Plains, Illawara, Shoalhaven, Yass Plains, Boree, and the river Thompson (Gipps Land).

In Van Diemen's Land the limestone belonging to this formation occupies both sides of the dividing range; and although much divided by the igneous rocks, it may, in all the localities, be still identified by the organic remains. The track of the western belt is indicated in four conspicuous localities, First, the Break-o'-day Valley, where the limestone lies at an altitude of 700 feet, incumbent on greywacke, and associated with greenstone. It is mostly massive, and contains numerous organic remains, and fragments of older rocks. The second locality, between Mona Vale and Ross, is at the height of 600 feet above the sea, where the limestone is associated with trachyte, and is fossiliferous; the third is north-east of Campbeltown; the fourth is on the west arm of the Tamar, where it is associated with greywacke and granular limestone. The eastern belt has also several localities where this limestone rock appears. First, the sources of the river Nive, where it is connected with granular limestone, and an arenaceous fossiliferous rock; second, the Eastern Marshes, where it appears in great fossiliferous masses, much fractured and dislocated by the intervening greenstones; third, the foot of Table Mount, where it is equally fossiliferous; fourth, Mount Dromedary; fifth, Mount Wellington. In the three last-mentioned localities the limestone contains many most interesting organic remains, which will be fully described in the Zoological Section of this work.

SEDIMENTARY ROCKS.

ARGILLACEOUS OR CLAY SLATES.

The clay slates which appear in the second epoch greatly differ, in a mineralogical point of view, from from those described under the first. They seldom possess a foliated structure; on the contrary, their stratification is often indistinct, and the fracture either slaty, conchoidal, or splintery. The numberless varieties of the rock, many of which differ only in colour, may be arranged under three species.

Var. 1. *Common Clay Slate* (shiste argileux).

Its colours are various: sea-green, yellow, bluish black, pearly grey, and reddish. It is dull, adheres to the tongue, and yields a strong argillaceous odour. Its streak is paler than the surface, structure earthy; it is soft; fracture, slaty.

Localities.—In New South Wales it is found on Mount Victoria; also between that locality and Mount King George; on the Middle and Northern Hunter, Campbell and Abernethy rivers; to the south of Arthursleigh, north of Modbury, east of Gidley; at Lake Omeo, and to the north and south of Gipps Land.

In Van Diemen's Land it appears between the mouths of the Great and Little Forrester rivers; at Emu Bay; Rocky Cape and Montague rivers.

Their inclination is irregular; their thickness does not exceed 25 feet.

Var. 2. *Claystone.* (Jameson.)

This assumes a variety of colours; chiefly yellowish white, lead grey, sky blue, and brick red. The stone is dull, massive, semi-hard, slightly adherent to the the tongue; it yields an argillaceous odour; the streak is similar; fracture is splintery, uneven, or, in some cases, conchoidal.

Localities.—In New South Wales it is found to the west of Arthursleigh; in the vale of the Clwyd; at Coyal; to the north-east of the Hunter; and at Lake George.

In Van Diemen's Land it occurs at St. Patrick's Head; at Lake Tomb, Ben Lomond; between Tamar and Rubicon rivers; on the river Forth; at the Western Bluff and the sources of the river Nive.

Var. 3. *Aluminous Slate.*

Colour, greyish black, sometimes verging on iron black; external and longitudinal fracture shining at times with a metallic lustre; structure slaty, with layers straight or curved. It is unctuous and brittle; fracture somewhat laminated.

Localities.—In New South Wales it is found at Walerowang, also at Balangola and Arthursleigh. In Van Diemen's Land it appears at Emu Bay, and at Cape Grimm.

GREYWACKE. (*Jameson.*)

A somewhat arenaceous compound, of a yellowish, reddish, or bluish colour; composed of quartz, with occasionally mica and glassy felspar, cemented by an indurated argillaceous or felspathic paste. Its structure varies from a coarse sandstone to a finely comminuted and compact mass, seldom possessing a distinct cleavage, or exhibiting a slaty appearance. Its external and internal aspects differ very little; generally it adheres to the tongue, and exhales an argillaceous odour.

Localities.—In New South Wales it is found at Port Stephen West; at Booral; on the Upper and Lower Hunter; between Bathurst and Frederick Valley; at Lake George, and on the Shoalhaven. In all these localities its geological position is between the uppermost mineral masses of the first epoch and the lowermost sedimentary deposits of the second.

In Van Diemen's Land, greywacke extends over larger tracts of country. It is found on the river Bobiala; at Cape Portland; Mount Cameron, where it is associated with eurite and clay slates; at St. Patrick's Head, where it lies between siliceous slate and limestone; at the confluence of the Tyne and South Esk, where it is associated with siliceous slate and clay slate; on the south side of Ben Lomond, and the west arm of the Tamar, connected with the granular limestone of those localities; at the eastern foot of the Western Tier, between breccia and clay slate; at the source of the Nive, along with clay slates and limestone; and between Emu Bay and Cape Grimm, constantly associated with siliceous slates, granular quartz rock, and clay slates.

General Remarks upon the Second Epoch.

The geological and mineralogical discrepancies which will be observed to exist among the sedimentary rocks above described, great as they appear, are nevertheless such as might have been inferred from an examination of the form of the first upheaved land, which served as a ground-work for the further enlargement of the geological edifice.

The form of this land has given rise to eddies and currents, which, judging by what we see in the present day in Bass's Straits, may have either powerfully assisted the general agencies which effect the abrasion, comminution, and dissemination of materials, and the reconstruction of rocks, or may have equally tended to counteract the effect of such. Thus the difference between two localities, arising either from a difference in the number or mineral character of the members of the series, or the abundance or paucity of the characteristic fossils, becomes only an evidence that one locality has been more favourably situated for the accumulation of certain geological records than another.

The organic remains which have distinguished this epoch had been found, by Mr. Lonsdale and Mr. Morris, to possess great analogies to those of the Palæozoic series. How far this analogy is borne out by the specific character of the Australian fossils, will be fully discussed in the able paper which these two eminent naturalists have furnished to the Zoological Section of this volume.

As regards the crystalline eruptive rocks, which have been noticed in more than one locality, partly as being merely associated with stratified rocks, partly as immediate causes of their dislocation, convulsed and confused groups as they present, their eruptions may nevertheless be referred to certain distinct and distant periods, and may be classed chronologically by means of the geognostic evidences furnished by the sedimentary rocks with which they are in contact. Thus the eruption of greenstone in the Liverpool, Coyal, and Honeysuckle ranges, those of the basalt along the spur which is crowned by Mount King George, and the eruption of both these rocks in the Westmoreland country, may be assigned to the period intermediate between the formation of the siliceous and aluminous detrital masses, and that of the aluminous and calcareous fossiliferous and non-fossiliferous sedimentary deposits. In all these three cases the siliceous and aluminous rocks, the lowermost of the series, were in position highly inclined, while those which follow are horizontal, or nearly so.

To this period belong also the most striking eruptions of greenstone in Van Diemen's Land, namely, those by which the completion of the actual dividing range from St. Patrick's Head down to Table Mount was effected, and those which formed the elevations of Ben Lomond, Ben Nevis, Mount Horror, Mount Barrow, Mount Direction, and Mount George. To this same period may likewise be referred the greenstone and basaltic spur running between Western Bluff and Asbestos Hills, and that which shoots out from St. Valentine's Peak to Mount Cameron West, with all those lateral branches that contorted the clay-slate system between Emu Bay and Cape Grimm. In all these localities of Van Diemen's Land, as in the preceding ones of New South Wales, the lowermost arenaceous and aluminous detrital masses are the only ones which are disturbed, and which have a highly inclined dip.

Again, the date of the eruption of porphyries and greenstone at Port Stephen must have been at the period at which the deposition of the slaty argillo-calcareous fossiliferous rock terminates, and before that at which the formation of the coarse sandstone with *conulariæ* and *terabratulæ* began. Coeval with this porphyritic eruption may be classed the eruption of porphyries at Barber's Creek, and that of porphyries, greenstones, and basalts at Mount Canoblas, Boree, Molong, Narrigell, Wellington, and the west of Yass Plains. In Van Diemen's Land, contemporaneously with these eruptions, took place that which produced the spur that shoots off from Table Mount, and is crowned by Mount Dromedary. In all these localities we see every member of the series, including the slaty fossiliferous, greatly disturbed.

Next after this period we can trace the record of disturbances which dislocated another member of the series, namely the arenaceous fossiliferous rock, which rests upon the slaty limestone. Effects of this event may be seen, in New South Wales, at St. Patrick's Plains and on Harper's Hill.

The latest eruption seems to have been that which intervened between the above-mentioned epoch and the following one, characterised by the deposition of coal. Its traces are visible on Mount Tomah in New South Wales, and on Mount Wellington and Dry's Bluff in Van Diemen's Land. They show that all the members composing the series belonging to the second epoch were affected by similar disturbances. In the case of the two latter localities, the eruption was of very limited extent; so that, while on the N. W. of Mount Wellington a part of the series is not disturbed, on the S. E. three of its newest members are dislocated, and the uppermost is severed, and elevated 2500 feet above the others. At Dry's Bluff, where the whole series is disturbed, the dislocated part is separated from the rest, to a superior height of 3900 feet. (Pl. V. fig. 2.)

THIRD EPOCH.

An inspection of the annexed map, in which the crystalline and sedimentary rocks of the preceding epoch are represented by the yellow colouring, will show, at the first glance, that the manner in which the mineral masses of that epoch were added to the original ground-work gave rise to the formation of basin-shaped localities, singularly adapted to the developement of the phenomena into which we are now about to inquire.

Three of these localties deserve particular attention. The first, in New South Wales, presents but the westerly marginal portion of a once great basin, which portion is now watered by the tributaries of the rivers Hunter and Hawkesbury, and which we shall call, for convenience sake, the Newcastle Basin.

The second, the South Esk Basin, in Van Diemen's Land, is confined partly to the vales of Avoca and Break-o'-day, partly to the country watered by the Macquarie and Blackman's rivers.

The last, the Jerusalem Basin, also in Van Diemen's Land, includes the Derwent valley as far north as Hamilton and Bothwell, together with the Richmond and Coal River valleys, and presents, like the basin of New South Wales, no more than its westerly and northerly sides unaltered; its extent to the south and east being only indicated by the geological features observable on Maria Island and Tasman's Peninsula.

The walls of the three basins appear to have a contemporaneous origin; but the deposits which they include seem to differ in point of date, and lead to the belief that the geological conditions under which they were produced were modified, in each locality, not only with respect to time, but as regards the nature of coal and other strata which they contain.

We shall now briefly pass in review the geological evidence observable in each of these localities.

NEWCASTLE BASIN.

The point from which the most comprehensive view of this basin may be obtained is Port Stephen.

There lies between that locality and the river Hunter, a small ridge, dividing the drainage of the river William from that of the Karua. This ridge is composed of breccia, gritstone, greenstone, and basalt. On its southern flank lies a coarse sandstone, containing *conulariæ*, *spiriferæ*, and *productæ*, subjacent to a conglomerate: these rocks constitute the uppermost members of the series of strata described in the preceding epoch, and both extending to the left bank of the Hunter. About the site of Raymond Ferry, the two members are found, at the level of the river, dipping to the south.

On crossing the Hunter, and taking a southerly course, we come on a ridge ranging E. and W., and composed of masses of sandstone, differing from that of the left bank of the Hunter. It is fine grained, contains mica and *iron glance*, and is in some places variegated by zones of different colours, in others interspersed with very thin seams of coal. On the southern side of the ridge, at Lake Macquarie, coal crops out from beneath this sandstone.

Should we now take an easterly course from the above locality until we reach the sea shore, and then proceed northerly, we should come in sight of a cliff, 200 feet high, and about 2000 feet long, displaying several seams of coal, arranged in parallel beds, of which the continuity is interrupted by faults, beautifully illustrating the dislocation of coal strata. (Pl. V. fig. 1.)

At the Island of Nobby, which stands between the cliff above mentioned and the opposite point of land forming the north head of Port Hunter, we find the coal strata dipping southward, and at the same angle of inclination at which we found the sandstone with *spiriferæ* and *conulariæ* dipping at Raymond Ferry.

On St. Patrick's Plains and the river Wolombi analogous relations between siliceous breccia, conglomorate, fossiliferous slaty rock, coal, and fine-grained sandstone are observable, confirming the inference that the ridge of siliceous breccia, greenstone, and basalt, between Port Stephen and the river Hunter, is part of the north-eastern margin of Newcastle Basin; and that the coarse sandstone with *spiriferæ* and *conulariæ*, with incumbent conglomerate (Raymond Terrace), is the floor of its coal deposits.

The seams of coal in the cliff above referred to, are not there accessible, but they may be examined in any of the coal-pits which are sunk on the sloping side of the elevation. That which is nearest to the fall of the cliff, gives the following section, in the ascending order:—

		Feet.
A.	Coal (the lowest of the deposit) - - -	3
B.	Greenish sandstone - - - -	50
C.	Coal - - - - - - -	3
D.	Greenish sandstone with blue veins - -	25
E.	Coal - - - - - - -	5
F.	Clay rock (greyish), and shale (bluish), with impressions of *Sphenopteris lobifolia, Sphenopteris alata, Glossopteris Browniana, Phyllotheca australis* -	43
G.	Coal - - - - - - -	5
H.	Cherts, gritstones, with angular fragments of flint intermixed with thin veins of coal - -	44
I.	Coal - - - - - - -	3
K.	Conglomerate (the uppermost of the deposit) -	23
		204

Besides the impressions of *Phyllotheca* and *Glossopteris*, there was also discovered an impression of a fish, but too imperfect to allow of the determination of its character.

To the westward and southward of the cliff above described, the conglomerate K. of the coal deposit is seen dipping to the westward, under masses of variegated and fine-grained micaceous sandstone, which, in that direction is found gradually to rise to the height of 3000 feet; attaining, in some places, a thickness of 1400 feet, as may be observed in the valley of the Grose.

The average strike of this sandstone on the north-eastern margin of the basin is S. E.; on the westerly margin it is E.; at the southern side, which is about Illawara, its strike is N.W.; the strata thus seeming to converge towards the county of Cumberland, the probable centre of the basin.

The variegated sandstone about Newcastle lies in a position conformable to the coal deposits; as is again the case with the latter, in relation to the Raymond Terrace conglomerates and sandstones, containing *spiriferæ*, *productæ*, and *conulariæ*.

SOUTH ESK BASIN (VAN DIEMEN'S LAND).

This basin is very limited in extent, and displays a margin much indented. Its section, taken from east to west, that is from St. Patrick's Head to Ben Lomond, presents, first, a greenstone axis, against which are abutted greywacke, clay slates, and grits, in vertical positions; next, a limestone rock, with spiriferæ, and a conglomerate, in horizontal beds; then, on the southern side of Ben Lomond, a seam of coal, over which lies a conglomerate and a variegated sandstone. The three last members of the deposits are dislocated, and uplifted 2100 feet above the actual level of the coal-beds. In this basin the variegated sandstone occupies the uppermost position amongst the sedimentary rocks.

JERUSALEM BASIN.

In going from the Eastern Marshes to Jerusalem, we observe, first, a limestone rock, containing *productæ* and *spiriferæ;* then, a conglomerate; and then, an outcrop of coal seams, — all dipping south. In Jerusalem coal-pits, the artificial section presents the following sequence of coal-beds, taken in the ascending order: —

		Feet.
A.	Coal (the lowermost)	2
B.	Blackish clay, with impressions of *Pecopteris australis* and *Zeugophyllites*	6
C.	Greyish clay	11
D.	Blackish clay, with the impressions of the clay B.	3
E.	Greyish clay	12
F.	Coal	3
G.	Blackish clay, with impressions similar to the clay B. and D.	2
H.	Grey clay	2
I	Clay slate	1
K.	Greenish sandstone	3
L.	Sandstone, with impressions of *Pecopteris odontopteroides*	13
		56

In the southern dip, which it assumes, the sandstone L. may be followed up to Richmond, where it is found, as at Jerusalem, on the top of the coal.

Beyond Richmond it may be further traced to the edge of the sea at Pitt's Water; and at the coal-pits of Port Arthur it is again found cropping out with coal. The coal deposit of those pits, taking all the beds together, has a total thickness of 150 feet; its two uppermost seams correspond with the two coal seams, A and F, noticed in the pits of Jerusalem, as do also the intervening shales in respect to their fossil plant impressions.

At the settlement of Port Arthur, farther south than the coal-pits of the same name, the sandstone only is to be seen, dipping, as it were, under masses of clays which compose the island of Point Puer, and which contain *Pachydomus globosus*.

The line which we have just reviewed, that is, that from Eastern Marshes, over Jerusalem, Richmond, to Point Puer, is dislocated in many places by greenstone; and the evidence it furnishes would therefore be of little value, had not the Jerusalem Basin presented additional evidence regarding the order of superposition.

These localities are,—the estate of Mr. Parsons, not far from Bothwell; Jericho; Nine Mile Marsh; London Inn, Spring Hill; Research Bay; South Port; and Maria Island. At the locality of London Inn, a section taken in a well sunk close to a police station, when I was engaged in exploring that part of the island, identify the sandstone of that locality with that of the Jerusalem coal-pit, as beneath it was the shale with the impression of *Pecopteris australis* and *Zeugophyllites* overlaying a seam of coal.

If we draw a line from London Inn to Hobart Town, it would correspond in direction with that drawn from the Eastern Marshes, through Jerusalem, Richmond, and Port Arthur, to Point Puer, and would cut through the following successions of rocks: a sandstone with impressions of *Pecopteris odontopteroides* superposed by masses of clay, lying on the side of Spring Hill, and containing *Pachydomus globosus.*

Both the sandstone and clay dip S. W. About Greenpond and Brighton these masses are succeeded by a different sandstone, which is fine, micaceous, and without impressions of *Pecopteris.* At Hobart Town it is overlayed by a yellow limestone rock, containing *Bulinus* and *Helix.*

The first line showed, then,—	*The second, conjointly with the section of the well at London Inn,—*
1. Coal.	1. Coal.
2. Shale, with impressions of *Pecopteris australis* and *Zeugophyllites.*	2. Shale, with impressions of *Pecopteris australis* and *Zeugophyllites.*
3. Sandstone, with impressions of *Pecopteris odontopteroides.*	3. Sandstone, with impressions of *Pecopteris odontopteroides.*
4. Masse of clays, with *Pachydomus globosus*	4. Masses of clays, with *Pachydomus globosus.*
	5. Variegated sandstone.
	6. Yellow limestone, with *Bulinus* and *Helix.*

The two above lines are greatly dislocated by greenstones and basalts, and do not offer a continuity of the enumerated members: both need a re-examination, by which the fact of the clays with *Pachydomus* existing in the position which apparently they occupy would be confirmed; and thus the question regarding the relative age of this coal solved. Until then, we can only admit as possible that the Jerusalem coal deposit may be somewhat anterior in date to those of the South Esk and Newcastle basins.

With the deposits of the three above-described basins we may connect partial outcrops of coal observed in a small valley called the Reedy Valley (the Vale of Clywd), north of Mount York, and east of Mount Clarence, and which seemingly belong to the Newcastle basin; a probability, however, rather invalidated by the fact of the coals overlaying masses of pure bitumen, — a circumstance not discovered to exist elsewhere.

The outcrops of coal observed by the late surveyor-general Oxley, to the northward of Port Stephen, at the heads of the rivers Hastings and MacLeay; those, again, noticed by Cunningham, at Moreton Bay, together with the outcrops of coal at Western Port,—are most probably indications of the margins of basins similar to that of Newcastle.

In all these outcrops of coal, masses of variegated sandstone appear above the coal strata: and this fact, connected with others, obtained in the examination of the Newcastle, South Esk, and Jerusalem basins, and of other tracts of the country, leads to the conclusion *that the variegated sandstone about Sydney, with the variegated sandstone and yellow limestone, with* Bulinus *and* Helix, *of Hobart Town, and above which no other formation has yet been found, constitute the highest beds in geological series of the two colonies.*

MINERALOGICAL DESCRIPTION OF ROCKS BELONGING TO THE DESCRIBED EPOCH, INCLUDING AN ANALYSIS OF SOME LIGNITES FROM ALLUVIAL DEPOSITS IN VAN DIEMEN'S LAND.

In the subjoined mineralogical description of some varieties of coal belonging to New South Wales and Van Diemen's Land, the specific gravity spoken of, has been ascertained by myself, through the means of a Nicholson's hydrostatic balance, capable of indicating distinctly differences equal to $\frac{1}{40000}$th part of the weight in the balance. The chemical character of each species and variety I have ascertained by two different analyses: —

1st. By that of separating the organic substance under examination into its proximate constituents.

2nd. By that of resolving it into its ultimate elements.

In the first analytical process, one portion of known quantity of coal was deflagrated by a known quantity of nitre; another portion was distilled in a small glass retort, — and the vapours which distillation yielded were condensed, as also the gases collected over water, into a graduated receiver. Thus, the quantity of *charcoal*, *bitumen*, *earthy constituents*, *coke*, and *coal-tar* was ascertained; and a further determination was made of the amount of *carbonic acid*, *sulphuretted hydrogen*, and the two sorts of *carburetted hydrogen*, contained in the gas receiver, by treating the gaseous mixture alternately with caustic potassa, carbonate of lead freshly precipitated from the acetate, and finally, with chlorine gas, both in darkness and in light.

In the second process, the elegant apparatus of Gay-Lussac and Liebig was made use of, and the oxide of copper freshly prepared employed as the oxydising agent. The *carbon* was estimated from the amount of carbonic acid absorbed by the balls containing caustic potassa, and the *hydrogen* from the amount of water absorbed, as shown by the increase in weight of the tube containing chloride of calcium. The *oxygen* was estimated from the loss of weight of the combustion tube, deducting the carbon and hydrogen, as also the *nitrogen*, which was previously ascertained.*

SLATY COAL.

Houille grasse. (*Brongniart.*)

Loc. —*Newcastle, N. S. W.*

Colour, black, with a slight tinge of grey; structure foliated; fracture even, the fragments of indeterminate form; it soils the fingers, and is soft and brittle; specific gravity, 1·31.

Chemical Character. — It burns easily, with a reddish flame; swells and agglutinates; its constituents are —

Charcoal - - - -	62·8
Bitumen - - - -	25·2
Earthy matter - - -	12·2

One pound yields 1 foot 1·806 cubic inches of illuminating unpurified gas. The gaseous mixture contains, in 100 volumes —

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* I shall seize this opportunity of offering my sincere and public acknowledgments to William Pugh, M.D., of Launceston, Van Diemen's Land, who, during my stay in that island, has lent me the use of his laboratory, and in many instances his personal co-operation, in the analysis of the Australian minerals and soils. Not less sincere thanks are due to Mr. Richard Phillips, F. R. S., and Mr. Richard Phillips, Jun., with whose able assistance I was enabled, last year, to complete, in the Laboratory of the Economic Geology, the remainder of the analyses, the result of which will be detailed in the Agricultural Section of this volume.

Sulphuretted hydrogen	10
Carbonic acid	10
Olefiant gas	17
Carburetted hydrogen	11
Other inflammable gas	52

Every one hundred parts in weight yield —

Coke	71·2
Coal-tar and ammoniacal liquor	15·6

Its ultimate elements, deducting the earthly matter, stand in the following proportion: —

Carbon	70·5
Hydrogen	20·4
Nitrogen	9·1

Slate Coal.

Loc. — *Western Port, N. S. W.*

Its colour is black, with a resinous and glistening lustre; structure somewhat slaty; fragments indeterminate angular; it is brittle; specific gravity, 1·38.

Chemical Character. — It burns with a bright flame; swells and agglutinates; its proximate constituents are —

Charcoal	54
Bitumen	35
Earthy matter	11

One pound is equal to two cubic feet of illuminating gas. The gaseous mixture contains, in each 100 volumes —

Sulphuretted hydrogen	11
Carbonic acid	10

Olefiant gas	20
Carburetted hydrogen	10
Other inflammable gas	49

Every 100 parts in weight yield—

Coke	65
Coal-tar	20

Its ultimate elements, deducting the earthy matter, will stand in the following proportion:—

Carbon	70·1
Hydrogen	16·2
Oxygen	3·0
Nitrogen	10·0

Geological Situation.—It occurs in beds of sandstone and indurated clay; clay slate and coal alternating with each other, with the exception of the roof and the floor of the coal being invariably a fine brick clay. No fossil plants had been as yet discovered in that coal.

COARSE COAL.

Houille grossière. (*Brongniart.*)

Loc.—Port Arthur, Jerusalem Basin, V. D. L.

Colour, steel grey, sometimes blackish; structure usually slaty; cross fracture coarse-grained; it is harder than the common slate coal, and heavier; specific gravity, 1·44.

Chemical Character.—It burns with difficulty, and slowly, unless kindled with wood, and emits little or no smoke; its flame is blue, and clear as that of anthracite, which, in its external character, it most resembles; it does not agglutinate, nor cake; its proximate constituents are—

Charcoal	86·0
Bitumen	3·5
Earthy matter	10·5

One pound yields 1½ cubic feet of illuminating gas, and some water strongly impregnated with hydrosulphurets, but no coke or tar. The gaseous mixture contains, in 100 volumes —

Sulphuretted hydrogen	18
Carbonic acid	12
Olefiant gas	3
Carburetted hydrogen	5
Other inflammable gas	62

Its ultimate elements, deducting the earthy matter, stand in the following proportions: —

Carbon	80·0
Hydrogen	8·8
Oxygen	2·0
Nitrogen	9·2

SLATY GLANCE COAL. (*Jameson.*)

Anthracite. (*Brongniart.*)

Loc.—Richmond, Jerusalem Basin, V. D. L.

Colour, bluish steel grey; structure, foliated; fracture slaty, sometimes composed of brilliant laminæ, variously arranged; specific gravity, 1·75.

Chemical Character. — It burns with difficulty, yields little or no flame, and no bituminous odour: its proximate constituents are —

Charcoal	60·0
Earthy matter	33·5
Water	6·5

One pound gives 1032 cubic inches of very feebly illuminating gas. No coke or tar were obtained in the process.

The gaseous mixture contains, in each 100 volumes —

Sulphuretted hydrogen	10
Carbonic acid	25
Other inflammable gas	65

Its ultimate elements, deducting the earthy matter, stand in the following proportion : —

Carbon	63·3
Hydrogen	25·2
Oxygen	2·5
Nitrogen	9·0

Bituminous Wood. (*Jameson.*)

Lignite Xyloide. (*Beudant.*)

Loc. — South Esk Valley, V. D. L.

Its colour is clove-brown; structure ligneous; cross fracture conchoidal; lustre shining and resinous; the fragments have the external appearance of compressed wood ; specific gravity, 1·29.

Chemical Character. — It burns easily, with a flame, without swelling or caking, and emits during combustion a sharp, fetid, and nauseous odour : its proximate constituents are —

Charcoal	33·8
Ligneous and bituminous matter	51·0
Earthy matter	15·2

Applied to the production of gas, one pound gives 3686 cubic inches of very impure and faintly illuminating gas.

Every 100 parts of weight yield —

Pyroxylic acid - - -	30·0

Its ultimate elements, deducting the earthy matter, stand in the following proportion: —

Carbon - - - -	70·0
Hydrogen - - - -	5·4
Oxygen - - - -	14·6
Nitrogen - - - -	10·0

Geological Situation. — It occurs in alluvial land, in detached masses, which are sometimes compressed, forming beds, of which one part is carbonised, while the other remains in the state of wood. The valley of the tributaries of the Derwent, and that of the tributaries of the Tamar, abound in lignites of this description.

SLATY GLANCE COAL. (*Jameson.*)

Anthracite. (*Brongniart.*)

Loc. — Recherche Bay, Jerusalem Basin, V. D. L.

Colour, iron black; structure compact; fracture slaty, and the layers frangible; specific gravity, 1·46.

Chemical Character. — It burns with difficulty, yields little or no flame, and no bituminous odour: its proximate constituents are —

Charcoal - - - -	74·4
Earthy matter - - -	20·0
Water - - - - -	5·6

One pound gives 1100 cubic inches of very faintly illuminating gas: no tar or coke were detected in this coal.

The gaseous mixture contains, in each 100 volumes —

Sulphuretted hydrogen	8
Carbonic acid	20
Carburetted hydrogen	20
Other inflammable gas	52

Its ultimate elements, deducting the earthy matter, stand in the following proportion: —

Carbon	14·35
Oxygen	4·50
Nitrogen	600

Geological Situation. — It lies among clays, in beds of two feet thick, in which no impressions of plants are perceivable, nor is any sandstone visible; and the want of a natural section precludes a more accurate detail: the two shafts, sunk to the depth of 150 feet below the crop of the seam, discover nothing but horneblende, dolerite, and steatitic rocks, with sulphate and carbonate of lime.

SLATE COAL. (*Jameson.*)

Houille grasse. (*Brongniart.*)

Loc. — Jerusalem V. D. L.

Colour, black; structure slaty, the layers dividing into brittle fragments of indeterminate angular shape; fracture even, lustre resinous and shining; specific gravity, 1·33.

Chemical Character. — It burns with a splendid white and reddish flame, and is easily lighted; emits black smoke, and swells and agglutinates: its proximate elements are —

The Upper Seam.		*The Lower Seam, at 32 ft. deeper.*	
Charcoal	64·0	Charcoal	25·0
Bitumen	32·0	Bitumen	10·0
Earthy matter	4·0	Carbonate of lime	57·0
		Silica	8·0

The coal of *the upper seam* gives two cubic feet of illuminating gas for every pound consumed.

It moreover gives, in every 100 parts of weight —

Coal-tar and ammoniacal liquor	12·6
Coke	77·0

The gaseous mixture contains, in 100 volumes —

Sulphuretted hydrogen	1
Carbonic acid	5
Olefiant gas	19
Carburetted hydrogen	11
Other inflammable gas	64

Its ultimate elements, deducting the earthy matter, will stand in the following proportion: —

The Upper Seam.		*The Lower Seam.*	
Carbon	72·2	Carbon	52·3
Hydrogen	14·4	Hydrogen	17·2
Oxygen	4·6	Oxygen	14·5
Nitrogen	8·8	Nitrogen	16·0

SLATE COAL.

Loc. — Jericho, Jerusalem Basin, V. D. L.

Specific gravity, 1·30.

Chemical Character. — Burns with a splendid white flame, and is easily lit: its proximate constituents are —

Charcoal	60
Bitumen	37
Earthy matter	3

One pound gives two cubit feet of an illuminating gas, like that obtained from the Jerusalem coal: the quantity of coal-tar is also the same, but there is less coke.

Its ultimate elements, deducting the earthy matter, are as follows:—

Carbon - - - - -	74·3
Hydrogen - - - -	10·4
Oxygen - - - -	4·2
Nitrogen - - - -	10·1

Geological Situation. — From the examination of the place where it is found, and of the intervening country between the Coal River and Jericho, this deposit appears to be a continuation of that of Jerusalem. Its external and chemical character, as well as geological situation, identify the seam with the upper one of the latter locality.

EARTHY LIGNITE.

Loc. — *Nine Mile Marsh, Jerusalem Basin, V. D. L.*

Colour, black; structure slaty, resembling coal; friable; soiling the fingers; specific gravity, 1·40.

Chemical Character.—Burns without flame or smoke; when exposed to strong heat, does not melt nor agglutinate: its proximate constituents are—

Charcoal - - - - -	40
Ligneous (not bituminous) matter	22
Water - - - - -	10
Earty impurities - - -	28

Geological Situation. — It lies in small beds, amongst greywacke and greenstones.

LIMESTONE ROCK.

The yellow limestone with *Bulinus* and *Helix*, and some impressions of leaves of an extinct vegetation, and which was noticed at Hobart Town, as the next to the sandstone, which forms the highest beds in geological series of the two colonies, presents mineralogically four varieties.

First Variety. — Its colour is yellow; its structure rather peculiar; without the assistance of a glass, appearing to be very fine-grained homogeneous mass; but when viewed through the microscope, showing an aggregate of angular fragments of a brownish yellow limestone. The structure of the fragments, as well as of the paste, is not discernible. The fracture is even and dull, but the glass discovers in the paste a splintery appearance. It does not adhere to the tongue, but exhales an argillaceous odour when moistened.

Second Variety. — Structure cellular, and in crusts, having delicate undulated seams, and each bounded by its own surface; fracture splintery, the fragments angular.

Third Variety. — Colour, brownish yellow; consists of distinct concretions, which are sometimes very fine, and only distinguishable by their glimmering lustre; sometimes coarse and granular; the fracture is uneven and shining, the fragments angular, the external and internal aspect similar; it does not adhere to the tongue, neither does it yield an argillaceous odour.

Fourth Variety. — Is of a light straw colour; structure massive, slightly perforated, and composed of minute concretions; fracture uneven, the fragments angular; the external and internal aspect dull and earthy; it adheres to the tongue, yields an argillaceous odour, and is moderately tough.

General Remarks upon the Third Epoch.

Associated with the above-described mineral deposits, in the Newcastle, South Esk, and Jerusalem basins, are found greenstone, basalt, and trachytic conglomerates, the eruption of which, as attested by the effects it produced amongst the stratified masses, took place at four different periods.

The first period of eruption is coeval with the deposition of the coal in Jerusalem basin; that is, it came after the deposition of the second seam of coal, and before that of the superincumbent clays; the said *seam* consisting of altered coal, from which the bitumen has been in a great part expelled, and its place supplied by carbonate of lime. (*Vide the Chemical Analysis of the Jerusalem Coal.*) The clays which lie above this seam are somewhat unconformable to it.

After this came the irruption of basalt and greenstone, which must have taken place between the deposition of coal and that of the variegated sandstone. Thus at Research Bay and South Port the coal is mostly charred and converted into coke from the immediate contact with the greenstone, while the variegated sandstone is left undisturbed.

The third and last period of irruption may be traced to the closing of this epoch. Besides other effects, which will be noticed in the following pages, it caused great dislocation, amidst both the coal beds and the superincumbent sandstones. At Mount Wingen, it raised the lower arenaceous rock, containing *spiriferæ* and *conulariæ*, from beneath the coal deposits which it threw out. In the Newcastle cliff, as represented in the section, it produced seven different dislocations through the irrupted greenstone which is seen under that cliff. At Port Arthur coal-pit, innumerable *faults* are also observable; and in the South Esk basin, the coal strata, with the variegated sandstone above them, were uplifted 2100 feet above the actual level of the basin.

FOURTH EPOCH.

Above the series of strata, and the unstratified masses, composed of materials differing in origin, age, and mineralogical and chemical character, are found, both in New South Wales and Van Diemen's Land, here and there, multifarious accumulations, some of which, as sand, gravel, pebbles, &c., are seen to rest upon the surface, in the form of *loose gravel or sand*, or transported matter; others, as the *elevated beaches*, are disposed in indurated horizontal beds; some like the *osseous breccia*, at Wellington, fill the crevices of the rocks; but the greater part lie in confused masses, and in a state of partial decomposition, either filling the bottoms, or lodged against the sides of the valleys.

We shall now briefly review the forms under which these different accumulations present themselves.

LOOSE MINERAL SUBSTANCES.

Amongst the transported matter, gravel, sand, and fragments of rocks, are found oxides, phosphates, sulphurets, and arseniates of iron, oxides of titanium, molybdiate of lead, cornelian, opal, agate, and agglomerated pebbles of compound minerals. The range of the last-named substances, scattered, as we find them, over the surface of the two colonies, combined with the fact of their being composed of minerals varying extremely in specific gravity, and of their exhibiting mostly an elliptical and flat shape, leads to the belief that the surface of the colonies has been gradually rising, and had been for some time exposed to the attritive action of shallow water, before it arrived at its present height above the sea.

ELEVATED BEACHES

Are disposed, at wide intervals, along the present coast of the two colonies: they present commonly horizontal beds, and occur at various heights above the existing sea; some showing marks of greater antiquity than others. Thus the elevated beaches at Lake King (Gipps Land) are seventy feet above the sea: they are composed of an indurated reddish clay and calcareous paste, containing *ostrea* and *anomia*, which are different from the existing specie; while the elevated beaches seen on the southern shore of New South Wales, between Cape Littrap and Portland Bay, contain *ostrea* of the present time, agglutinated by a gritty paste. The elevated beach which forms Green Island, in Bass's Straits, is again but a comminuted mass of shells, and rises to the height of 100 feet: that of the south-west point of Flinders Island exhibits the same character. The two last beaches are abutted against granite, sienite and greenstone.

At ten miles south of Cape Grimm, and west coast of Van Diemen's Land are found, at 100 feet above the present sea, elevated beaches, similar to those of Bass's Straits, and approaching in structure to a coarse and porous sandstone. The beds of these beaches are within the zone of clay slate of the second epoch, and in the vicinity of basalt and trachytic conglomerates.

At Table Cape, the raised beach contains —

Dentalium,
Venus,
Turritella,
Tellina,
with *Sponges* and *Corals*.

It rests upon basalt, and is seventy feet above the level of the sea.

The character of these elevated beaches, and their occurrence in localities widely separated, furnish important additions to the evidence collected in other parts of the world, not only respecting the agencies which still operate in uplifting the earth's surface, but to the local and confined manifestations of such upheavings.

OSSEOUS BRECCIAS.

Among the instances of brecciated accumulations in clefts or caves, the most remarkable is the osseous breccia of the Wellington Valley. The caves in which it is contained are similar to other limestone caverns: the nature of the breccia, in regard to the aggregation of the organic remains and brecciated rocks, does not present any characteristic marks of difference from other similar compounds; and the presence of both kinds of matter in this locality appears as difficult to account for here as the ossiferous caves in Europe.

The Wellington caves are nevertheless of great interest and importance, recording periods of terrestrial revolution in this country similar to those which have happened in other parts of the world; and presenting to us the remains of some of the land animals which were the first inhabitants of Terra Australis.

All their remains, hitherto discovered, consist of detached bones much broken, and very frequently in fragments. The genius, however, of Cuvier and Owen, to whom a broken tooth or vertebra has often sufficed for deciphering the form and character of the entire animal, has supplied the deficiency and the incompleteness of the Australian records.

It is thus that the Australian bones have been found to belong to extinct animals, some of which are unknown to naturalists, as the *Diprotodon*, and *Noto-*

therium; — some, as the *Macropus*, *Hypsiprymnus*, *Phascolomys*, *Dasyurus*, *Thylacinus*, presenting but typical forms of the existing species.

Availing myself of the liberality of Professor Owen, who has contributed the largest share towards our knowledge of the Australian fossils, I shall, in another place, lay an abstract before the reader of some of his most interesting papers relating to the subject.

DEBRIS ACCUMULATED IN VALLEYS.

Throughout the two colonies, the valleys are characterised by the more or less excellent soil they afford to agriculture. These soils differ much in different places, and possess characteristics by which they may be classified. Upon what that classification depends; what are the productive powers of each class; how far industry has availed herself of the virgin soils; and to what degree those under cultivation are susceptible of improvement,—will be discussed in the Agricultural Section, which closes this volume. But, independent of soils, the valleys possess fossil trees of great interest; some, as at Dart Brook and at Lake George, New South Wales, in fragments, imperfectly fossilised; some again, as in the Derwent Valley, Van Diemen's Land, in the form of truncated trees or stumps, perfectly opalised, imbedded in porous and scoriaceous basalt and trachytic conglomerate.

No where, to my knowledge, is the aspect of fossil wood more magnificent than at the place last mentioned; and no where is the original structure of the tree better preserved: while the outside presents a homogeneous and a hard glassy surface, variegated with coloured stripes, like a barked pine, the interior, composed of distinct concentric layers, apparently compact and homogeneous, may be nevertheless separated into longitudinal fibres, which are susceptible of subdivision into almost hair-like filaments.

These valuable remains were examined, contemporaneously with my own visit, by Dr. Hooker, of H. M. Ship "Erebus," then bound on the South Polar expedition; and I shall quote, in the language of that zealous and distinguished botanist, the description of the characters which the fossil trees present.

"The most remarkable circumstance," says Dr. Hooker, describing one of the opalised trees, "is the manner in which the outer layers of wood, when exposed by the removal of the bark, separate into the ultimate fibres of which it is composed, forming an amianthus-like mass on the *ventricle* of the stump in one place, and covering the ground with a white powder, commonly called, here, native pounce. The examination of a single concentric layer from this part, shows that it may be detached from the contiguous layers of the preceding and following year's growth; there being no siliceous matter infiltrated into the intervening spaces. A portion of each layer is found to have a second cleavage, not concentric with, but in the direction of its radius, or of a line drawn from the centre to the bark of the tree. Such a cleavage is to be expected from the fact, that it is in the direction of the medullary rays that traverse every where the woody tissue. Each of these laminæ is of extreme tenuity, of indeterminate length, and of the breadth of the layers of wood; and is formed of a single series of parallel woody fibres, crossed here and there by the cellular tissue of the medullary rays, which do not generally interfere with their regularity. These plates, again, are separable into single minute fibres, which are elongated tubes of pleurenchyma or woody tissue, tapering at either end into conical terminations of indefinite length. They lie together in such close approximation that the microscope does not detect an interstice, though the least force separates them.

"From the appearance of the fossil, its coniferous structure is almost self-evident. But to prove that it was a pine wood, as nearly as our present knowledge of fossil botany will admit of, it is necessary to examine so thin a slice that the nature of the woody fibre may be microscopically observed by transmitted light: such slices have hitherto only been prepared by the most skilful lapidary, and at a great cost. In this instance the wood is already separated into lamellæ admirably adapted for this purpose, and far more beautifully than could possibly be effected by hand. Under these circumstances, with a good microscope, each of these fibres is seen to bear the distinctive character of pine-wood, being marked with a series of discs, considered as glands, and which constitute the glandular woody tissue.

"The nature of these discs is still, perhaps, disputable, and is not immediately connected with the present subject. Such a structure is nearly confined to the conifera, and is essential to them, so far as we at present know.

"Hence it is almost certain that the present fossil belonged to trees of an order whose different species never grow separately, but cover immense tracts of land with, often, a gigantic vegetation.

"How the silification was effected without there existing a bond of union between the separate fibres, is a most interesting question; and further, the nature of the cleavage of the fossil, some other circumstances connected with it, and the ease with which it can be examined, may be expected to add much to what is already known of the physiology of trees, their growth and developement."*

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* "Tasmanian Journal of Natural Science," &c. No. I. p. 25.

The tree described by Dr. Hooker is found at Rose Garland, the property of Mr. Barker, to whom great credit is due, not only for having discovered this relic, but for the pains he has taken to preserve it from the injury of Vandal collectors. His unremitting exertions have led to the discovery of some other most interesting fossils, particularly of casts, in basalt, of consumed trees, which throw light upon the state of the forest at the time of the irruption.

Not less wonderful than these fossil trees, and equally interesting, are the erratic blocks or boulders found in the same valley of the Derwent. The masses are composed of cylindrical, somewhat flattened, columns of basalt, confusedly heaped together, with a detritus of pebbles mixed with spheroid boulders of greenstone rocks, all lodged against an escarpment situated at the bottom of the valley, and on the right bank of the Derwent.

This escarpment belongs to the carboniferous strata, and was once connected with another escarpment running across the bed of the river, so as to dam up the present outlet of the waters, and thus to form, in conjunction with the other lines yet existing, the perfect and continuous margin of a basin. The violence with which this embankment was burst asunder is obvious, as is also the action of the water upon it. The position of the detritus, and the direction of the axes of the columns, which lie in position corresponding to the present fall of the country, that is at the lowest level of the valley, prove that the disturbing forces acted from within the basin.

This is corroborated further by the evidences of the basaltic and trachytic irruption which occurred after the deposition of the variegated sandstones in Van Diemen's Land. That irruption seems to have appeared first about Rose Garland, which is the centre of the valley. The trees there, which had been fossilised, withstood the intensity of the incandescent matter: other trees, placed in circumstances less favourable to their previous fossilisation, were consumed; but being either saturated with water, or still green, they resisted in some measure the process of combustion, and have left behind longitudinal moulds in the basaltic scoriæ, with parietal cavities and impressions, similar to the rugged appearance which the carbonisation of a tree assumes externally. Into some of these moulds, a second irruptive force appears to have injected fresh lava, thus forming casts of the consumed trees, and records of the succession of volcanic agencies.

This irruption was followed by that of greenstone in the upper part of the valley; which, accompanied as it was by a sudden upward movement of the bottom, must have precipitated the waters from one side of the basin to the other, by which, the barrier being ruptured at the place where the present escarpment is seen, the drainage of the valley was effected.

In this movement an area of 1200 square miles seem to have been raised to the height of 4000 feet, and the valley to have been overflowed by streams of greenstone and basalt issuing from five mouths — the present lakes of the so-called upper country of the Derwent. (Pl. V. fig. 2.)

CONCLUSION.

In our attempt to sketch the general physical aspect of New South Wales and Van Diemen's Land, we have followed a continuous chain of mountains for upwards of 1500 miles — first along the eastern coast of New Holland to Wilson's Promontory; thence to Bass's Straits; thence again, in zigzag direction, through Van Diemen's Land; beholding it every where towering above the country through which it winds its course.

The lithological character of this chain, and that of the spurs which belong to it, has been found to be chiefly due to the presence of crystalline rocks; the irruption of some, being confined to particular epochs, while that of others has extended itself to all the geological eras — into the newest, with which our inquiry has closed.

Thus the irruption of granite, sienite, hyalomicte, and protogene was stated to have taken place only at the beginning of the first epoch; that of quartz rock and porphyries, during the first two epochs; that of basalt and its varieties, during the last two; while that of the greenstone operated continually throughout all the four.

These facts tend to the following conclusions:—

1. That the continuity of the chain in the mean direction of N. E. to S. W., connected as it is by the islands of the Straits, shows that the action of the force which up-heaved it was *uniform in direction.*
2. But although uniform, the movement was not *synchronous*, on the whole line, but was exerted during four different and distinct epochs.
3. That the difference in the height of the peaks, which range between 6500 and 1000 feet above the sea-level, proves that the uplifting movement was exerted with different degrees of intensity.
4. That the position and the character of the foci of the maximum and minimum of that intensity is such as to lead to the connection of the origin of the chain of mountains with a series of volcanoes of "*elevation*," operating along a longitudinal fissure of the earth ranging from N. E. to S. W.

5. Lastly, that from the lithological character, and from the geological phenomena which have been found grouped along its course, the above mountain chain may be looked upon as the Australian Eastern Axis of Perturbation.

The sedimentary rocks which we have seen divided by that axis, and at present incumbent upon it, have been traced to four different epochs.

The FIRST is characterised by the presence of mica-slate, argillaceous and siliceous slate, and the *absence of gneiss.*

The SECOND, by the arenaceous, calcareous, and argillaceous stratified deposits, and by the following organic remains which pervade them:—

POLYPARIA.

Stenopora informis (Lonsdale).
——— *tasmaniensis* (Lonsdale).
——— *ovata* (Lonsdale).
——— *crinita* (Lonsdale).
Fenestella ampla (Lonsdale).
——— *internata* (Lonsdale).
——— *fossula* (Lonsdale).
Amplexus arundinaceus (Lonsdale).
Hemitrypa sexangula (Lonsdale).
Favosites gothlandica (Lamarck).

CRINOIDEA.

Crinoidal columns or stems.

CONCHIFERA.

Allorisma curvatum (Morris).
Orthonota compressa (Morris).
——— *costata* (Morris).
Pachydomus antiquatus (Morris).
——— *globosus*
——— *cuneatus* (Morris).
——— *lævis* (Morris).
——— *carinatus* (Morris).
Eurydesma cordata (Morris).
Pecten illawarensis (Morris).
——— *Fittoni* (Morris).
——— *squamuliferus* (Morris).
——— *limæformis* (Morris).
Pterinea macroptera (Morris).

BRACHIOPODA.

Terebratula cymbæformis (Morris).
——— *hastata* (Sowerby).
Spirifer crebristria (Morris).
——— *Darwinii* (Morris).
——— *Stokesii* (König).
——— *subradiatus* (G. Sowerby).
——— *avicula* (G. Sowerby).
——— *vespertilio* (G. Sowerby).
——— *tasmaniensis* (Morris).
Productus brachythærus (G. Sowerby).
——— *subquadratus* (Morris).

GASTEROPODA.

Littorina filosa (J. Sowerby).
Turritella tricincta (Morris).
Platyschisma oculus (Morris).
——— *rotundatum* (Morris).
Pleurotomaria Strzeleckiana (Morris).
——— *cancellata* (Morris).
——— *nov. spec.* (Morris).

HETEROPODA.

Bellerophon micromphalus (Morris).

PTEROPODA.

Theca lanceolata (Morris).
Conularia levigata (Morris).

CEPHALOPODA.

Orthoceras—(Much damaged, and not determined).

CRUSTACEA.

Bairdia affinis (Morris).
Cythere, species of (Morris).
Trilobites—(Small impressions of, not exceeding half an inch).

PISCES.

Icthyodorulite.

The THIRD EPOCH includes coal deposits, with their intervening shales and sandstones, in which were found—

Sphenopteris.
———— *lobifolia* (Morris).
———— *alata* (Brongniart).
Glossopteris Browniana (Brongniart).
Pecopteris australis (Morris).
———— *odontopteroides* (Morris).
Zeugophyllites elongatus (Morris).
Phyllotheca australis (Brongniart).

The FOURTH and last EPOCH is marked by the occurrence of elevated beaches, in which are found, —

Dentalium.
Venus.
Turritella.
Tellina.
Anomia.

And by the organic remains of land animals, occurring in the limestone, caves, or alluvial deposits, and which are identified with—

Diprotodon.
Nototherium.
Macropus.
Hypsiprymnus.
Phascolomys.
Dasyurus.
Thylacinus.

The evidence above referred to shows, —

1. That the stratified rocks of New South Wales and Van Diemen's Land, from mica-slate upwards, reach only to the variegated sandstone inclusively, that sandstone being incumbent upon the coal deposits in New South Wales and Van Diemen's Land.
2. That their thickness does not exceed 2200 feet, in which sandstone alone is 1400 feet; — and, lastly,
3. That, though inconsiderable in thickness, and limited in the number of the organic remains which they contain, the sedimentary rocks of New South Wales and Van Diemen's Land furnish, nevertheless, new evidence in support

of those geological laws, which have been derived from the examination of Europe.

Comparing now the area of the crystalline with that of the sedimentary rocks, it is found, —

1. That in New South Wales the space occupied by the crystalline is to that of the sedimentary rocks as 3 : 1.
2. That in Van Diemen's Land it is as 7 : 1.

A classification of all the mineral masses, whether unstratified or stratified, into two divisions, the one including rocks having more than sixty per cent. of silica, the other less than the above per centage, shows, —

1. That in New South Wales the area of granite, protogene, hyalomicte, quartz rock, sienite, siliceous breccia, quartzose porphyry, siliceous slate, sandstone, and conglomerate, all containing above sixty per cent. of silica, is, to the area of eurite, felspathic porphyry, greenstone and basalt rocks, containing less than 60 per cent., as 4·1 : 1.
2. That in Van Diemen's Land, on the contrary, the area of the first division is to that of the second as 1 : 3.

This *inverse ratio* of siliceous to non-siliceous rocks in the two colonies, while it decides the question of the relative agricultural character of soils of each colony, shows, in the mean time, the effects of the volcanic agencies, which appear to have operated on a more extensive scale in Van Diemen's Land than in New South Wales.

Indeed, the torn, rugged, furrowed, and contorted surface of the former colony, bears ample witness to the formidable revolutions produced by the eruptive greenstone and basalt, overwhelming, in succession, different members of the series, which then composed the consolidated crust, and sweeping away and burying a vegetation, of which no living traces are now left on the island.

But these changes have served only to render this island one of the most eligible spots on the face of the globe for the pursuits of agriculture: the irrupted greenstone yields an excellent soil, and the zigzag course of the chain of mountains forms naturally flat-bottomed valleys, between which rises a table-land about 3800 feet, enclosing in crateriform lakes five reservoirs of water, covering, if the surface were united, an area of 200 square miles, and capable of irrigating all the adjacent lands available to cultivation.

New South Wales exhibits few records of irruptive igneous rocks, and preserves all its crystalline siliceous rocks in addition to the siliceous sedimentary ones, which in the course of ages have accumulated upon its surface.

This difference in the predominant kind of rocks, and in the configuration of the surface, will probably assign to each colony a different form of future prosperity.

New South Wales, by the nature of its soils, seems destined apparently to become a pastoral, Van Diemen's Land an agricultural country.

To hasten the development of that destiny, to pave the way, not only for a successful investigation of other branches of physical science, but to lead directly to the improvement of agriculture, and the success of commercial projects in various departments, a regular geological survey of the two colonies cannot be too strongly recommended; and such a survey as the science of the present day requires can only be accomplished by the aid of the Government, and by the pursuit of the same liberal system, which has already organised the Geological Ordnance Survey in the United Kingdom.

The "Economic Geology" might thus become the centre of a geological survey, not only of the British islands, but of the British empire; and might include, within its already valuable museum, all the specimens relative to the colonies; thus concentrating within its walls the information which now must be sought for in remote and widely distant regions.

To achieve any complete geological survey of such countries—as, *e. g.*, New South Wales and Van Diemen's Land—by private enterprise, is out of the question. Besides the expense, time, and labour, which such a task requires, and the necessary means of publishing the results which it needs, there is one insuperable difficulty in the way of a private individual, from the simple fact of his entering on the field of his researches in *a private capacity*. His functions ought to be *official ;* not because an official character would carry, in matter of science, greater weight and authority than private and well-known skill, but because the official geologist would find unrestrained access to every nook of the country to which his inquiry would lead him, and would be placed at once above that suspicion, by which the inhabitants of every new country are inclined to question the purity of the intentions that actuate the naturalist, often rendering his progress unpleasant, and sometimes dangerous.

The present geological outline, thus constructed, as it has been, from materials comparatively scanty, and gathered under many disadvantages, cannot be better concluded than by borrowing a passage from an admirable essay, on a subject of the highest importance.*

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* Essay towards a First Approximation to a Map of Cotidal Lines, by Professor Whewell.

"I should regret its publication, if I supposed it likely that any intelligent person would consider it otherwise than *an attempt to combine such information as we have, and to point out the want, and the use of more;* I shall neither be surprised, then, nor mortified, if the outline which I have drawn turns out to be in many instances widely erroneous."

SECTION IV.

CLIMATOLOGY OF NEW SOUTH WALES AND VAN DIEMEN'S LAND.

INTRODUCTION.

NEXT to the science of geology, there is no part of physical geography which ranks higher, or claims greater attention than meteorology; though as yet, notwithstanding its connection with the most essential studies of natural philosophy, and with the most vital concerns of mankind, the state of this science is such, that, beyond a mere collection of simple facts, and of registers recorded patiently, yet without the guidance of any satisfactory theory, no contribution of superior character, tending to any deductive reasoning, can legitimately be made to it. The mode even of exhibiting such facts, so that they may be placed in harmony with the general laws of physics, and in the pre-eminence corresponding to their climatic agencies and influences, is still attended with considerable difficulty.

In the following disquisition on the climate of New South Wales, and Van Diemen's Land, the plan adopted has been, to trace that climate to its proper attendant causes; to analyse separately, so far as is possible, these causes and their effects, together with their mutual dependence on each other, and the share each of them bears in the economy of nature. Thus, atmospheric currents, winds, atmospheric pressure, calorific effect of solar rays, terrestrial absorption, and radiation of heat, diaphaneity of the atmosphere, evaporation, rain, and temperature, have all been alternately reviewed, and their respective and collective agencies investigated.

An attempt has next been made to link the isolated effects into one expressive or connected group, and to give, if possible, an approximate general idea or picture of that bountiful climate with which the two colonies have been gifted.

The numerical elements which have guided the writer in this investigation were obtained during five years, ending with 1842 inclusive. They were derived, —

1st. From the meteorological register of the barometer, thermometer, rain and wind, kept by the assistant commissary, Mr. Lempriere, in Port Arthur, Van Diemen's Land; the number of observations being	21·600
2dly. From two separate registers, one kept at Circular Head and the other at Woolnorth, the estate of the Van Diemen's Land Company, and embracing observations similar to those of Port Arthur, to the number of	43·200
3dly. From three separate registers kept at Port Macquarie, Port Jackson, and Port Philip (New South Wales), by order of the Colonial Government, and including observations of the barometer, thermometer, hygrometer, wind and rain, to the number of	25·900
4thly. From my own register of the barometer, hygrometer, thermometer, solar and terrestrial radiation, evaporation, diaphaneity, rain, winds and currents, of which the observations amounted to	17·280
Total	107·980

To the above 107·980 numerical elements must be added those which resulted from simultaneous observations of phenomena made in different localities of the two colonies, and in which I was aided and assisted by some friends, and by none more than my enlightened and valued friend, Capt. P. P. King, R. N., who not only took his share in these labours, but gave me free access to his own meteorological register, kept for years in New South Wales; and, which was not less important, kindly condescended to give his opinion on the section when it was completed. I may add, that the approval of it by that able judge and keen observer, in April, 1843, has operated as one of the leading motives for its present publication.

ATMOSPHERIC WINDS AND CURRENTS.

To the facts connected with winds and currents, so admirably collected and reasoned upon by Dove, in his *Meteorologishe Untersuchungen;* by Schouw, *Beiträge zur Vergleichenden Klimatologie;* by Redfield, in his valuable observations *On Hurricanes;* and by Colonel Reid, in his not less valuable work *On Storms,*—'a few additional data, derived from personal observations, in different parts of the world, are here added; some, as corroborating what the above-named eminent meteorologists have already noted; some, as new phenomena, tending to extend our still limited knowledge of the subject.

Considered merely in relation to New South Wales and Van Diemen's Land, and to the influence they exercise upon the climate, the atmospheric winds and currents present themselves to the observer as foremost in rank amongst climatic agencies.

Their respective actions, manifestly of various character and various intensity, appear in some instances to be mere expressions of an accidental perturbation in the atmospheric circulation; in some others, their periodical return, and uniform course, direction, force, and succession, show that they are governed by a law as immutable as that which regulates the course of seasons; while in other instances, again, their movements is of a subordinate character, like that of an eddy, depending upon the direction and intensity of a stronger current.

In all cases, however, their action on the climatic changes is so ramified and complicated in its agency and influence, that the atmospheric pressure, the hygrometrical, thermometrical, and diaphanic state of the ambient air, the calorific effects of solar rays, and, lastly, the animal and vegetable life, are all affected by their presence and action.

Both currents and winds disclose, through the courses of clouds, that the number of superposed belts or strata of circulation, their respective direction and velocity, are subject to infinite variation*, but that their movement with respect to our planet is constant, being, so far as the evidence has gone, either parallel to the earth's surface, or at low angles of inclination to it. To this may be added, that a calm in one region of the atmosphere, and a strong agitation and circulation in another, whether below or above it, is of common occurrence, as is also a diametrically opposed movement between that circulation and the surface winds.

The register of currents and surface winds kept during four years, and condensed in the following table (p. 163.), leads to the belief that, as regards the difference between their respective directions, the *ratio* of that difference follows the increase and decrease of the sun's declination.

The observations collected in ascending high mountains tend to establish the general fact, that the thermometrical condition of these currents is as variable as their direction; and that, contrary to the

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* "It is obvious, from the courses of clouds and other light bodies which sometimes float in the atmosphere, that the movements of the latter are mainly horizontal, or parallel to the earth's surface. Notwithstanding this, the common theory of winds supposes a constant rising of the atmosphere in the equatorial regions, connected with a flow in the higher atmosphere towards the polar regions, and a counter flow at the surface towards the equator, to supply the ascending current. This movement, however, has never yet been discovered; and it is easy to perceive that, if it existed in the manner supposed, its magnitude and velocity must be altogether too great to have eluded observation."—*Meteorological Sketches.*

TABLE I.—*Showing the Monthly Number of Currents, contrary in Direction to Surface Winds.*

Time of the Year.		Number of Contrary Currents.			
		1839.	1840.	1841.	1842.
Decl. ⊙ S.	January	29	24	27	20
	February	24	18	26	27
	March	20	27	29	26
Decl. ⊙ N.	April	15	10	9	12
	May	10	8	10	7
	June	4	3	8	2
	July	6	5	1	3
	August	9	15	13	8
	September	9	17	12	15
Decl. ⊙ S.	October	18	28	17	27
	November	25	25	20	24
	December	28	22	23	26

law of hydrostatics, the *colder current moves between two warmer, entirely by virtue of its volume.* Thus, on ascending Mouna Roa (Sandwich Islands), I noted, within the elevation even of 6000 feet, three currents, of different directions, intensity, and thermometrical condition. That of Hilo (Byron's Bay) was a very light S.E. current, with a temperature of 86°; that at an elevation of 6000 feet was a brisk N.W. wind, temperature 67°; while, as an intermediate between these, at an elevation of 4000 feet, a strong westerly wind moved in the temperature of 55°. On Mount Kosciuszko, New South Wales, the stratum of air at 3000 feet was considerably colder, during the daytime, than at the elevation of 6500; and in ascending Ben Lomond (Van Diemen's Land) a similar fact was observed. Moreover, on the last-named mountain, 5002 feet above the level of the sea, I encountered, on the 28th of November, 1841, before noon, a thunder storm, coming from the equatorial region, and attended with copious rain, and a temperature of 56°. On the same day, about four o'clock in the afternoon, it became calm and clear above, misty around, and densely clouded below; while at Avoca Vale, 4200 feet lower down, to the leeward of

Ben Lomond, there fell at the same hour (four o'clock) a hail storm, which thus must have originated in a stratum of air far below the point of congelation, and moving between 5002 feet and 800 feet of elevation, and between the 56° temperature of Ben Lomond and the 80° which was the temperature of Avoca Vale before the outbreak of the storm. This storm was in both places succeeded by a polar wind.

To these facts may be added that of rain being often observed to fall in Van Diemen's Land, on a winter's morning, when the temperature is below the freezing point; and that also of the melting snows which I witnessed on the crest of the Cordillieras in Chili, at an elevation of 15,000 feet, while the snow lower down, at the elevation of 10,000 feet, was found unaltered.

Independently of these thermometrical phenomena, the currents are attended by some extraordinary ones, as exemplified in their respective oscillations from one region to another. Thus, an upper current of a lower temperature than the surface wind has been observed to dislodge that wind, and to take its place, as was most probably the case in the above reported phenomenon of hail, in which the equatorial wind that accompanied the storm on Ben Lomond, was succeeded by the polar wind, after the latter had discharged its elements of hail on Avoca Vale.

In the action of the one current upon the other, a gradual commingling of the two currents not unfrequently takes place; sometimes that action is abrupt; and, in that case, the deflection of the lower current is immediately followed by an increase of atmospheric pressure.

This is well exemplified in both New South Wales and Van Diemen's Land, where the sudden southerly squall rapidly succeeds a N. W. or W. wind, and produces a rise in the barometer.

The only laws, however, that can be detected as governing the circulation of these currents, so little

[illegible]

VAN DIEMEN'S LAND

accessible to analysis, are those denoted by the surface winds in their annual and periodical returns, their similar climatic influences, the directions they usually take, and the constant course they follow, in displacing each other, &c. Thus, the examination of the meteorological registers kept at Port Macquarie, Port Jackson, Port Philip, and Port Arthur, show uniformly, at each of those stations, —

1. That the winds, in veering, follow constantly one course, viz., from the right to the left of the meridian facing the equator.

2. That the return of a N. W. hot wind is regular every summer season.

3. That, as regards the influence of winds on the thermometrical condition of the ambient air, those between N. and N. W. are invariably connected with the maximum of temperature; while, on the contrary, the S. and S. W. are associated with the minimum.

4. That as regards their hygrometrical state, the N. and N. W. winds are the driest, and the S. S. E. and S. W. are the least dry.

5. That the winds which blow from the S. E. and S. W. quarter are associated with the maximum of atmospheric pressure, and those between N. E. and N. W. with the minimum, with the exception of the hot wind (N. W.), which causes the barometer to rise.

6. That as regards rain, its maximum at Port Philip, and the northern and southern parts of Van Diemen's Land, is seemingly dependent upon the agency of the N. E. and N. W. quarter; while the maximum of Port Macquarie and Port Jackson is accompanied invariably by winds from the S. E. and S. W.

Thus confirming the law which Prof. Dove had established, in his *Meteorologishe Untersuchungen*, not only as regards the inverted rotation of winds in the two hemispheres, but also their inverted effect on the barometer, thermometer, hygrometer, and pluviometer.

Again, each of these registers discovers a series of similar annual phenomena, but of so strictly local recurrence, that it becomes at once evident that, to the general laws which govern the atmospheric circulation, some other modifying laws, of a purely local nature, must be admitted.

Of these phenomena, the most prominent are the prevailing winds at each station, as exemplified in the following table, in which the total number of all the winds during a season is represented by 100.

TABLE II.—*Of the prevailing Winds in New South Wales and Van Diemen's Land.*

Year.	Quarter of the Wind.	Winter.					Summer.				
		Pt. Arthur.	Launceston.	Pt. Philip.	Pt. Jackson.	Pt. Macquarie.	Pt. Arthur.	Launceston.	Pt. Philip.	Pt. Jackson.	Pt. Macquarie.
1840 -	N.	0·36	not observed.	0·19	0·09	not observed.	0·12	not observed.	0·13	0·35	not observed.
	N. E.	0·08		0·23	0·06		0·20		0·00	0·15	
	E.	0·03		0·06	0·05		0·06		0.02	0·14	
	S. E.	0·01		0·05	0·14		0·06		0·32	0·25	
	S.	0·03		0·17	0·21		0·12		0·33	0·06	
	S. W.	0·18		0·07	0·25		0·17		0·06	0·01	
	W.	0·09		0·09	0·14		0·06		0·02	0·00	
	N. W.	0·22		0·15	0·07		0·18		0·09	0·04	
Prevailing winds in 1840	-	N.	-	N. E.	S. W.	-	N. E.	-	S.	N.	
1841 -	N.	0·30	0·27	0·33	0·13	0·07	0·13	0·28	0·14	0·22	0·03
	N. E.	0·09	0·22	0·04	0·06	0·05	0·14	0·38	0·00	0·22	0·30
	E.	0·07	0·19	0·02	0·03	0·00	0·12	0·10	0·03	0·20	0·13
	S. E.	0·02	0·18	0·18	0·10	0·14	0·06	0·08	0·44	0·21	0·17
	S.	0·08	0·03	0·13	0·18	0·11	0·13	0·02	0·21	0·05	0·06
	S. W.	0·19	0·02	0·07	0·31	0·32	0·20	0·05	0·05	0·03	0·23
	W.	0·12	0·01	0·10	0·12	0·12	0·11	0·00	0·02	0·04	0·04
	N. W.	0·12	0·06	0·12	0·06	0·18	0·10	0·07	0·10	0·03	0·01
Prevailing winds in 1841	-	N.	N.	N.	S. W.	S. W.	S. W.	N. E.	S. E.	N. E.	N. E.
1842 -	N.	0·29	0·19	0·10	0·12	0·07	0·10	0·21	0·08	0·20	0·01
	N. E.	0·10	0·53	0·01	0·05	0-06	0·06	0·29	0·06	0·22	0·37
	E.	0·08	0·08	0·03	0·06	0·03	0·12	0·12	0·01	0·16	0·12
	S. E.	0·02	0·04	0·13	0·16	0·02	0·03	0·15	0·32	0·21	0·02
	S.	0·07	0·00	0·23	0·05	0·06	0·17	0·06	0·25	0·08	0·03
	S. W.	0·17	0·01	0·08	0·41	0·39	0·11	0·09	0·10	0·05	0·22
	W.	0·12	0·02	0·08	0·10	0·31	0·16	0·02	0·08	0·01	0.20
	N. W.	0·13	0·12	0·33	0·04	0·05	0·24	0·04	0·09	0·05	0·02
Prevailing winds in 1842	-	N.	N. E.	N. W.	S. W.	S. W.	N·W.	N. E.	S. E.	N. E.	N. E.

At Port Arthur, then, the N. W. wind, as the table shows, prevailed during three succeeding winters; while, during the same winters, the S. W. prevailed at Port Jackson.

Again, during the three succeeding summers, a southerly wind prevailed at Port Philip; while, at Port Jackson, during the same seasons, the prevailing wind was northerly.

Farther, it appears, that of the four principal quarters of the compass, the northerly and southerly quarters furnish the greatest number of winds at each station, and that their numerical relations vary with seasons, and with each locality, thus: —

In Winter. — Van Diemen's Land, in each 100 winds, receives from the S. W. + S. + S. E. quarters 17 winds, and from the N. W. + N. + N. E. 68 winds, making the polar to the equatorial as 1 : 4.

New South Wales, at its northerly stations, Port Macquarie and Port Jackson, has on the average, in each 100 winds, 60 proceeding from the S. W. + S. + S. E., and 21 from the N. W. + N. + N. E., making the polar to the equatorial as 3 : 1. At Port Philip, however, the S. W. + S. + S. E. quarters furnish but 38 in each 100, while the N. W. + N. + N. E. give 50, making the polar to the equatorial as 1 : 3.

In Summer. — Van Diemen's Land has, in each 100 winds, 28 which blow from the S. W. + S. + S. E. quarter, and 52 from N. W. + N. + N. E., making the polar to the equatorial as 1 : 1·8. At Port Jackson and Port Macquarie, there are, in each 100 winds, 22 proceeding from S. E. + S. + S. E., and 42 from N. W. + N. + N. E., thus rendering the proportion of the polar to the equatorial, as 1 : 2. At Port Philip, the S. W. + S. + S. E. quarters give 69 winds out of 100, and the N. W. + N. + N. E. but 21, the polar to the equatorial being as 3 : 1.

From these numerical elements it follows, —

1. That in Van Diemen's Land the equatorial wind prevails during both summer and winter.

2. That at Port Philip it is the equatorial in winter, and the polar in summer, that prevail.

3. That at Port Jackson and Port Macquarie the winter season is marked by the prevalence of polar winds, and the summer by that of equatorial.

These discrepancies in the prevailing winds, on a littoral of but 13 degrees of latitude, are striking and extraordinary.

The influence of the sun's declination cannot account for them; neither can they be explained by any local cause: but it is highly probable that they may be successfully traced to the influence of monsoons and winds which are found to exist within a certain distance of Terra Australis.

Consulting the valuable Appendix to Captain P. P. King's *Minute Surveys of New Holland*, or Horsburgh's *Indian Directory*, we find, as constituting the atmospheric circulation of the vicinity of New Holland, —

1. In winter, the easterly monsoon to the northward of that continent, and the W. and S. W. winds prevailing to the southward of it.

2. In summer, again, the westerly monsoon and the S. E. and S. winds prevailing, with some exceptions quoted by Horsburgh, both as regards S. W. and S. E. winds, and those also which are on record as having been observed during the summers of 1841 and 1842, and in which the W. and S. W. prevailed.

Now, by projecting the direction of these monsoons and winds, according to the limits and causes which Flinders, King, and Horsburgh assign to them (Pl. I. fig. 1.), we see that the littoral of New Holland is surrounded by an exterior belt or circuit of atmospheric circulation, varying with the seasons, as regards its direction, but constant in motion and intensity, and which must necessarily impart to the remaining central atmospheric fluid, of different densities, certain regular eddies, similar to those observed in the sea or in large rivers.

Indeed, were we to determine the form and direction of these atmospheric eddies simply from the analogous motion of other fluids, taking into consideration the influences of the vertical and horizontal configuration of the country upon which they strike, we should obtain a diagram, representing such determinations in curves very similar to those which are furnished by elements of actual observation.

Thus, during the three succeeding winters, the eastern monsoon, and the W. and S. prevailing wind imparted to the ambient air of New South Wales an eddy, of which the centre or axis was the great mountainous district west of Sydney; and the direction, as might be expected, was from the right to the left, facing the equator. In the course of its developement, its southerly segment, striking on the westerly coast of Van Diemen's Land, and the high chain of mountains which fronts it, was inevitably deflected into a subordinate eddy on the eastern part of the island, and resolved into a movement which accounts for the prevailing N.E. wind at Port Arthur, Launceston, and Port Philip; and the S.W. at Port Jackson, and Port Macquarie. (Pl. II. fig. 1.)

Thus again, in the summer of 1840, the W. and S.E. "outside" winds involved the interior air in a rotatory motion from left to right, facing the equator; and which air, revolving on the identical axis of the winter circulation, and meeting with no obstacle on the eastern coast of Van Diemen's Land, performed an uninterrupted circuit, and produced a N.E. wind at Port Arthur, a S. at Port Philip, and a northerly at Port Jackson. (Pl. III. fig. 1.)

In the following summer, 1841, the centre of the wind's rotation was again the same as that shown in the diagram of former seasons; its direction from left to right, facing the equator, being such as the monsoon would naturally impart to it; but owing to the prevalence of the W. instead of the S.E. winds, a segment of the eddy reaching to the latitude of Flinders Island, and meeting the opposite wind in Bass's Straits, which is on all occasions extremely strong, was split, or rather bifurcated, producing a S.W. wind at Port Arthur, a N.E. at Launceston, a S.E. at Port Philip, and a N.E. at Port Jackson and Port Macquarie.

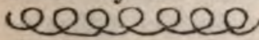
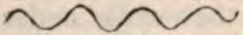
In the summer of 1842, from the prevalence of the westerly "outside" wind, the courses of winds around the littoral of the two colonies was similar to that of the preceding summer, except that the inclination of the lower current, which was deflected on Van Diemen's Land, took a more easterly direction, producing N.W. winds at Port Arthur, N.E. at Launceston, S.E. at Port Philip, and N.E. at Port Jackson and Port Macquarie. (Pl. IV. fig. 1.)

In one of these seasons (1842), during which the westerly winds, instead of the easterly, prevailed, I was engaged in exploring the islands of Bass's Straits, and witnessed on several occasions the effects of the conflict of two antagonist currents, the N.E. and W. I shall relate but one instance, extremely favourable to the illustration of the case before the reader.

On the 13th January, 1842, I ascended, from the westward, the highest peak of Flinders Island, which Captain Stokes, of H.M. surveying ship the "Beagle" has done me the honour of naming Strzelecki's Peak (2550 feet). On making the ascent, the wind was westerly; on descending the mountain on the eastern side, the wind was N.E. The "Eliza," a colonial vessel from Hobart Town, bound for Launceston, passed Banks's Straits about noon, with a N.E. wind, yet met in the longitude of Cape Portland a strong westerly breeze. The same day the "William," Captain Tom, returning to Launceston from Sydney, met in Bass's Straits an easterly breeze, and made Port Dalrymple with a westerly one; while the "Mary Ann," from Hobart Town, bound for Melbourne, passed Banks's Straits with a N.E., but entered Port Philip with a S.E. wind.

However interesting the study of these currents may be to science, there is no phenomenon that has stronger claims upon the attention of a meteorologist, none that presents itself as a more legitimate subject of physical inquiry, than that commonly known in New South Wales and Van Diemen's Land under the name of the *hot wind.*

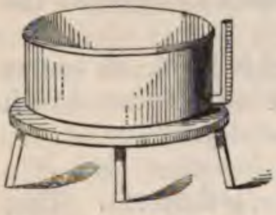
The mean direction of this wind is N.W.; its course ranges, therefore, within that of winds associated with the maximum of temperature and dryness.

Its velocity exceeds in some instances that of a regular gale; its motion, however, is different. That motion along the surface, as observed by the light bodies floating in the air, appears at times as if produced by a rotation on a set of horizontal axes : at times as resulting from a *ricochet* movement, thus, — ; in which case its effect is that of a wind blowing by puffs.

Its thermometrical condition on the westerly side of the dividing range is such, that the mean temperature of a summer day is increased by its influence 40°; on the eastern side, the increase, both in New South Wales and Van Diemen's Land, ranges between 25° and 30°: caloric, therefore, seems to be an inseparable concomitant of this wind.

All the visible moisture of the atmosphere, from the cirrus-stratus clouds to the light vapours floating above the marshes and rivers, disappears at the approach of the hot wind: rain never occurs while it lasts; and, notwithstanding the sky's apparent clearness from vapours and clouds, both the formation of the dew and the sun's radiation are interfered with.

The temperature of the wet thermometer reaching in New South Wales 78°, and in Van Diemen's Land 72°, while the temperature of the dry thermometer in the one country was 117°, and in the other 90°, indicates strongly the extreme dryness of the hot winds, but does not lead to any calculation showing the absolute measure of actual evaporation which takes place from the surface of the country swept by it. By means of an evaporating dish, to which a glass tube and scale, and a *vernier*, was affixed, and by which one thousandth part of an inch of evaporation could be indicated, a more direct result, though still of only an approximate nature, was obtained. The annexed figure shows the construction of the instrument.



The elements furnished by the daily register of the above gauge may be summed up in the following fact, that while under ordinary circumstances the mean of evaporated water in New South Wales and Van Diemen's Land during three hours is equal to 0·045 of an inch, under the influence of the hot wind that evaporation in three hours reaches 0·150. This leads naturally to the conclusion that dryness, or a peculiar power of decomposing or dispersing the atmospheric moisture, is the characteristic property of the hot wind.

When daily observing the sky, it is not uncommon, during the prevalence of this wind, to see the high clouds, cirrus and stratus, at once disappearing, whilst in the lower clouds no change is remarked.

In one instance, being obliged, for the completion of observations, to stop for a week on the top of Ben Lomond (Van Diemen's Land), I experienced the hot wind at the altitude of 5002 feet. At my depôt, 3000 feet lower to the windward, this wind was not felt; hence the hot wind is not confined to any particular altitude, but exists sometimes as a surface wind, and at other times as a wind moving above the ambient air.

From personal observations, it appears not less evident, that as this wind is felt in one locality, and not in another, within the zone or track of its course, so its movement is not always parallel to the earth's surface, but at different angles of inclination: thus, in the valley of the Tamar, Van Diemen's Land, the hot wind was felt on several occasions at Break-o'-day and in Campbeltown, but not in Launceston, though the locality offers no obstruction to the progress of a wind.

The stratum of air immediately overlaying the surface of the country swept by the hot wind is generally of a highly rarified character, and produces all the known phenomena of the Mirage.

The air of the upper stratum is, on the contrary, of prodigious density and great refracting power. Thus, three thermometers exposed to the action of the vertical rays of the sun, one covered with black wool, another with an equal quantity of white, and a third blackened with lamp-black, indicated the following temperatures: —

Before the Hot Wind.

	In New South Wales.	In Van Diemen's Land.
The two thermometers covered with wool showed a difference - - -	10°	8°
The thermometer blackened for solar radiation	145°	143°
The thermometer in the shade - -	79°	66°
The wet thermometer - - -	59°	60°
Pressure reduced to zero of temperature -	30·020	29·943.

During the Hot Wind.

	In New South Wales.	In Van Diemen's Land.
The two thermometers covered with wool showed a difference - - -	0°	1°
Thermometer blackened for solar radiation -	120°	108°
Thermometer in the shade - -	117°	90°
The wet thermometer - - -	78°	72°
Pressure reduced to zero of temperature -	30·250	30·187.

The hot wind, then, according to the numerical elements which observation furnishes,

Impedes the calorific effects of solar rays;
Decreases their intensity;
Increases the temperature of the ambient air;
Increases the temperature of the hygrometer;
And, finally, increases the atmospheric pressure.

The influence of this wind on vegetation, both indigenous and exotic, is extremely injurious. All the *graminæ* and *leguminosæ* are parched by it, and the fruit of the *Ficus australis*, as well as that of the vine, is destroyed. The red and blue grape commonly lose their colour and their watery elements; the green leaves turn yellow and wither; the quality of the crops is generally deteriorated, and whole fields of of most promising wheat and potatoes are often laid waste.

Its effects on the human constitution partake sometimes of the character of those produced in Egypt by the sirocco or simoom; a feverish heat and determination of blood to the head; and, in those subject to disorders of the lungs, a restrained action in breathing, at times bordering on suffocation, are symptoms confined to the whites alone: the suppressed perspiration, or rather its rapid evaporation, the relaxation of the muscles and vessels, inflammatory attacks, affections of the glottis, and ophthalmia, are common both to the aborigines and European races. The last-named disease, called in Australia, "the blight," presents symptoms identical with those observed in the ophthalmia of Egypt.

From the circumstance of my being unassisted in my observations of all the various meteorological phenomena which are commonly associated with the hot wind, some allowance will I hope be made for the incompleteness of this notice. Such as it is, it will afford sufficient ground for venturing upon an analysis, and for tracing at least the proximate cause, or causes, of the properties which the hot wind of New South Wales and Van Diemen's Land uniformly displays.

Thus the circumstances of its velocity and its motion, whether rotary or *ricochet*, by which impalpable particles of earthly matter are raised in the air, combined with the mineralogical and physical character of the particles thus raised *, will lead us to the solution of the question respecting the high temperature of the hot wind: for when we consider the power of absorption of solar heat possessed by that dense medium of floating particles, and their power of radiation towards the earth, we have a full explanation of the anomalous fact, that with the decreased solar intensity, as shown by the blackened thermometer, there was a considerable increase of heat in the ambient air.†

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* In sailing from New Zealand to New South Wales, in the "Justine," I was prevented making the harbour of Port Jackson for two successive days by the violence of the hot wind. The distance from the shore, on the parallel of Sydney, was sixty miles, and the heat exceeded 90°. The lee sails and reefs of the "Justine" were covered with a quantity of impalpable dust, which was at first mistaken for ashes; but, on examination, proved to be a sand, containing one-fourth of aluminous and three-fourths of siliceous and metallic matter. Those who shape their course to the East Indies by way of Cape Verd Islands may have seen the same effect produced by the north-east African hot wind.

† That keen observer Humboldt, reflecting upon the anomalies of the temperature of Mourzouk in the Fezan, as stated by Ritchie, and

But the fine bodies floating in the air are endowed with other properties besides that of increasing, by absorption and radiation, the solar heat: they are susceptible of acquiring an electric property, by means of friction, pressure, contact, or caloric.

Now, the motion of the wind, and the solar action, combine all these means and necessary conditions to the full developement of that electricity, which, once effected, becomes again a cause of the extreme dryness of the hot wind; for electricity promotes evaporation (Volta, Saussure); and the observed disappearance of clouds and vapours, with the drying up of the watery elements in leaves or tender plants and fruits, are but modified effects of that evaporation.

The zone, then, of this hot wind may be looked upon as a huge electric apparatus, highly charged, and endowed, not *with a capacity for moisture, but with the power of dissolving moisture, in whatsoever form it is collected.*

Under the head of rain, it will be proved that the hot wind begins only to show a capacity for moisture, and an increase in saturation, when the southerly current interposes between it and the sun, and when heat, light, and motion, the necessary conditions of electricity, are interferred with.

Nor is the deleterious effect of the hot wind on human constitution a phenomenon more inaccessible to analysis than are the causes of its heat and dryness: for when we bear in mind the fine particles of dust floating in the air, we can readily explain, by their highly electric state, the causes of ophthalmia, and its inflammatory character; and when we add to

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corroborated by Captain Lyons, said, " Mais l'air de l'oasis de Mourzouk n'est il pas constamment chargé de poussière, de petits grains terreux qui s'échauffent bien autrement que l'air, et qui par leur rayonnement élèvent la temperature des basses couches de l'atmosphére?" — *Asie Centrale*, vol. iii. p. 177.

what has been said already, that, at the altitude in which the hot wind is at times seen moving, a proportional increase of carbonic acid in the atmosphere is found (Saussure), and that, in the deflection of the wind to the surface which follows, this amount is added to that which is left unconsumed by the crisped vegetation, the farther causes of the deleteriousness suggest themselves in the origin of the new and noxious gaseous compounds which a disturbed economy of nature has necessarily entailed upon the atmosphere.

But New South Wales and Van Diemen's Land are not the only countries where the hot wind is felt: in other parts of the world that phenomenon is attended with aggravated effects, both on animal and vegetable life.*

No datum, however, is as yet offered, by which one could legitimately indulge in a theory concerning the origin of this remarkable meteorological phenomenon: neither is there a sufficient collection of facts and observations to bear out the tempting and inviting conclusion, that the winds similar to the hot wind of New South Wales and Van Diemen's Land, which have been observed, partly by myself, partly by others, in Egypt, Abyssinia, Syria, Arabia, Bombay, Diabekir, Persia, California, and Atacama, are associated by a common origin, or belong to a common system of atmospheric circulation.

ATMOSPHERIC PRESSURE.

As regards the subject of atmospheric pressure in New South Wales, it is to be regretted that the barometrical registers of Port Macquarie, Port Jackson, and Port Philip, began only so late as 1840, and that the records of that year being incomplete, and the barometrical observations of the following year being interrupted at Port Macquarie by an accident which happened to the instrument, the only registers that furnish any barometrical data are those of Port Jackson and Port Philip, for the two years ending with 1842.

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* Vide, Edin. Cabinet Library, *Africa*, p. 414. et seq.; Denham's Travels, Edin. Cabinet Library, *Arabia*, vol. i. p. 68.; Beeloochistan, by Pottinger; Bruce's Travels, vol. vi. pp. 466. 494. 3d edition; Burckhardt, Malcolm, Morier, and Lamartine (in the MS. of Falih Jalla), Voyage en Orient.

In Van Diemen's Land, the stations of Port Arthur, Circular Head, and Woolnorth each furnished their quota of barometrical observations, which exhibit, throughout five years, ending with 1842, a most praiseworthy perseverance, accuracy, and good faith, on the part of the observers.

To the above registers may be added my own, kept for four years, ending with 1842, and which, beside the daily observations of the barometer, furnishes some horary ones, undertaken with the view of ascertaining the rate of horary oscillation of the atmospheric tides.

The period which these registers embrace is trifling, compared to that which is required for obtaining a sufficiency of material for meteorological influences: the intervals also between the observations are too great, separating them too widely, and consequently limiting the range of their application.

Still, as they form the first record of a series of barometrical observations on the Australian continent, they deserve to be examined, if but to show the great importance which an accumulation of similar observations would have on future speculations.

As a preparatory step to their appreciation, the numerical elements which they give have been reduced to one common term of comparison, and exposed in tabular forms most appropriate to illustrate the phenomena to which they relate; a labour which can only be appreciated by those meteorologists who have reduced and computed similar observations.

Three tables have resulted from the computations: the first includes the means of bihorary observations, the hours marked with an asterisk being interpolated.

The second gives the mean height of the barometer, and its mean monthly oscillation, for the two seasons of each year.

The third and last brings the means of seasons to the last term of averages.

Diurnal Variation of the Barometer.—From the inspection of the first, second, and third column of Table III., it is evident that the average of five, ten, or fifteen days of consecutive observations (day and night) embraces too limited a series for the discovery of a law in connection with this variation. The average of twenty days in July rendered a regular oscillation of the barometer in some degree apparent, and has led to the belief that the hours of such oscillation are only perceptible in an average of a series of observations extending over more than twenty days.

Thus the fifth column embraces twenty-five days, and shows pretty clearly that the barometrical oscillation in August assumed a maximum at noon, a minimum at three p. m., a maximum again at seven, and again a minimum at eleven. After midnight, at one o'clock, the barometer attained a maximum; at three it came to a minimum; at five, to a maximum; at seven, to a minimum; and at eleven, to a maximum again. Consequently, in twenty-four hours, the barometrical oscillation exhibited nine phases, four of which were minimum, and five maximum.

Computing now, from these oscillations, the mean of the diurnal variation, after Humboldt's method, that is, taking the difference between the two extremes of morning and evening, and that variation would be only = 0·085.

Interesting as the subject is, its investigation is nevertheless inaccessible to the best efforts of a single observer, upon whom the duty of other observations and labours may devolve. We must therefore content ourselves for the present with conjectures only upon the developement of the laws of diurnal variation, and wait for the final solution of the question the results of the labours that are going on in the Hobart Town observatory, where, as we have already said, ardent and indefatigable observers are recording, night and day, all the phenomena connected with terrestrial physics.

Mean Height of the Barometer.

TABLE III.

OF THE HORARY OBSERVATIONS OF THE BAROMETER DURING THE WINTER MONTHS.

Launceston, lat. 41° 26′ 5″	Average of 5 Days' Obs. in April.	Average of 10 Days' Obs. in May.	Average of 15 Days' Obs. in June.	Average of 20 Days' Obs. in July.	Average of 25 Days' Obs. in August.
Noon -	29·659	29·852	29·831	29·906	29·863
1 o'clock -	29·628	29·908	29·860	29·856	29.792
*2 -	29·604	29·860	29.895	29·830	29·785
3 -	29·580	29·812	29·931	29·805	29·779
*4 -	29·543	29·781	29·920	29·815	29·785
5 -	29.506	29·751	29·910	29·826	29·792
*6 -	29·477	29·727	29·861	29·837	29·799
7 -	29·448	29·703	29·812	29·849	29·806
*8 -	29·443	29·742	29·831	29·829	29·793
9 -	29·438	29·781	29·851	29·810	29·781
*10 -	29·440	29·803	29·855	29·757	29·758
11 -	29·442	29·825	29·860	29·705	29·736
Midnight -	29·506	29·838	29·839	29·728	29·787
1 -	29·570	29·851	29·819	29·751	29·839
*2 -	29·590	29·860	29·784	29·756	29·795
3 -	29·610	29·870	29·750	29·762	29·752
*4 -	29·630	29·925	29·766	29·773	29·797
5 -	29·650	29·960	29·783	29·785	29·843
*6 -	29·665	29·916	29·742	29·822	29.832
7 -	29·680	29·873	29·702	29·860	29·822
*8 -	29·700	29·813	29·746	29·886	29·857
9 -	29·720	29·753	29·790	29·911	29·893
*10 -	29·705	29·775	29·796	29·983	29·913
11 -	29·690	29·797	29·802	29·956	29·934

TABLE IV.

OF THE MEAN ATMOSPHERICAL PRESSURES AND MEAN BAROMETRICAL OSCILLATION FOR THE TWO SEASONS OF EACH YEAR, REDUCED TO 32° OF FAHRENHEIT.

DATE.	Port Jackson.		Port Philip.		Woolnorth.		Circular Head.		Port Arthur.	
	Pressure.	Oscillation.	Pressure.	Oscillation.	Pressure.	Oscillation.	Pressure.	Oscillation.	Pressure.	Oscillation.
1838.										
Summer - -	Not observed.	Not observed.	Not observed.	Not observed.	29·951	00·830	29·735	00·971	29.728	00·800
Winter - -	—	—	—	—	29·873	00·910	29·790	01·000	29·560	01·210
1839.										
Summer - -	—	—	—	—	29·790	00·955	29·520	00·870	29·281	00·949
Winter - -	—	—	—	—	30·088	00·935	29·910	00·903	29·560	01·081
1840.										
Summer - -	—	—	—	—	29·953	00·821	29·783	00·846	29·225	00·867
Winter - -	—	—	—	—	30·160	00·883	29·761	01·065	29·536	00·895
1841.										
Summer - -	29·485	00·636	29·710	00·630	29·903	00·906	29·496	00·818	29 588	01·020
Winter - -	29·630	00·695	29·893	00·880	30·096	01·093	29·806	00·973	29·810	01·034
1842.										
Summer - -	29·340	00·730	29·748	00·663	29·933	00·895	29·635	00·695	29·631	01·029
Winter - -	29·550	00·890	29·755	00·920	30·038	01·001	29·906	01·040	29·696	00·859

TABLE V.

LOCALITY.	Geographical Position.		Summer Means.		Winter Means.		Annual Means.	
	Latitude.	Longitude.	Pressure.	Oscillation.	Pressure.	Oscillation.	Pressure.	Oscillation.
	° ′ ″	° ′ ″						
Port Jackson - -	33 51 11	151 19 45	29·412	00·646	29·590	00·792	29·501	00·719
Port Philip - - -	38 18 0	144 38 0	29·729	00·683	29·824	00·900	29·776	00·791
Woolnorth - - -	40 44 0	144 43 0	29·906	00·881	30·051	00·964	29·978	00·922
Circular Head - -	40 45 0	145 17 0	29·634	00·840	29·835	00·996	29·734	00·918
Port Arthur - -	43 11 40	148 6 0	29·490	00·933	29·652	01·015	29·571	00·974

Mean Height of the Barometer. — The unequal and irregular atmospherical pressures between Port Jackson and Port Philip are apparent throughout their respective registers. The discrepancy of that pressure between Woolnorth and Circular Head are not less so, notwithstanding that these localities are situated on the same latitude of the northern littoral of the island, and separated by only twenty minutes of longitude.

Reduced, however, to winter and summer means, as seen above in Table IV., the height of the barometer in each station, discovers a rate which is constant and regular at the return of each season; and when the means of seasons are reduced to the last term of averages, as in Table V., it shows farther, that, within the extent of 12° of latitude, the locality of the maximum of atmospheric pressure, during summer and winter, is Woolnorth, from whence, to the north and south, the pressure decreases. In that decrease, Circular Head is almost isobarometrical with Port Philip, as Port Arthur is with Port Jackson.

Barometrical Oscillations. — Of these, the monthly maximum and minimum coincide in data throughout New South Wales and Van Diemen's Land, with some remarkable exceptions, which will be noticed hereafter. The differences which they give in the means of seasons are, at each station, uniformly greater in winter than in summer; at both seasons, nevertheless, as shown by Table V., the amplitude of oscillation uniformly diminishes from Port Arthur, the extreme south, to Port Jackson, the extreme north, of the space embraced by the meteorological survey.

This decrease in the oscillation from the pole to the equator, which, according to the Australian observation, is, in every degree of latitude, equal in summer to ·0287 of an inch, and in winter to ·0223, is a fact so generally applicable to every part of the globe where the barometer has been recorded, that it becomes, as Saussure has justly said, a phenomenon that must be accounted for by every hypothesis which pretends satisfactorily to explain the barometrical oscillations.

Before venturing on the analysis of the results which are derived from the registers of New South Wales and Van Diemen's Land, it is most important to review, in a few lines, the progress which has been made in Europe in the study of atmospheric pressures, a study which as yet, for lack of the needed observations, presents more problems than solutions.

Lamanon, the naturalist of the ill-fated expedition of La Peyrouse, was the first who detected a regular variation in the daily range of the barometer, embracing two maxima and two minima, in twenty-four hours; and Humboldt, whose name is associated with every branch of terrestrial physics, made it a subject of special inquiry. With him, indeed, may be said to have commenced, in all parts of the world, a series of the most elaborate observations, which have led to the discovery, that the differences of this variation are greater at the equator than they are in the higher latitudes; and that the hours at which the changes happen vary according to the altitude at which they are observed.

De Buch, again, extended the study of the diurnal variation of the barometer to that of its monthly oscillation; and came to the conclusion that, in the entropical regions, the height of the barometer decreases as the sun approaches to the zenith. Dove extended the inquiry still further, and proved, by accumulated observations, that its rise and fall are influenced by seasons.

These discoveries rendered the existence of some laws evident, and gave rise to most ingenious speculations as to the causes on which they may depend.

Professor Daniell, in his valuable meteorological essay, confessing all the difficulties with which the question of the barometrical fluctuation is beset, ventured nevertheless an opinion upon its causes; which opinion, from the fact of its never losing sight of the decrease of the barometrical oscillation from the poles to the equator, deserves the greatest attention of meteorologists.

The hypothesis of Professor Daniell rests upon the assumption of an atmospheric circulation between the poles and the equator, in which circulation "the cold dense air of the former region flows in a lower current to the latter; while the elastic air of the latter is returned in an upper current to the former;" and farther, upon a change in the thermometrical state of the two currents, which must naturally effect an unequal distribution of the ponderable matter, and consequently an unequal distribution of atmospheric pressure, at all the intermediate stations between the equator and the poles; the changes are throughout traced and analysed, and identified with the theory, which, as far as the scanty numerical elements relating to the subject allow us to infer, is perfectly accordant with actual observation.

Kämtz, again, following up the march of the barometer and thermometer, in different localities, was struck with the fact, that whenever one of the instruments was observed to rise, the other showed a fall. The examination and comparison of the observations of pressure and temperature made at Bagdad, Buda, Cambridge (Massachusetts), Eyaford (Iceland), and St. Fé de Bagota, localities most different in climate, and most distant in position, did but confirm him in the opinion that the barometer and thermometer assume an inverse ratio in their respective oscillations. Furthermore, the experiment with Leslie's differential thermometer, and the consideration and analysis of the effects which a difference of temperature between two distant localities would produce both on the thermometer and the barometer, led him to this remarkable conclusion, that "whenever the barometer falls in a country, the temperature of that country is higher than that of the countries which are in its vicinity; and, on the contrary, when the barometer rises, that country is colder than those by which it is surrounded. *

But Dove, who discovered a connection between the hygrometrical condition of the air and the barometer, referred the variation of the atmospheric pressure to it. His disquisition on the observations of Neuber in Andrade, detailed in the Poggendorff's *Annalen der Phisick*, and his final reduction of the tension of vapours to the hourly pressure of a dry atmosphere, bear, like his other labours, contained in Dove's *Repertorium*, the stamp of unusual research and unwearying zeal in the discovery of truth.

Two more hypotheses relating to this interesting subject deserve to be recorded here.

The first is that of Bouger, who deduced the variation of pressure from the calorific effects of solar rays.

The last is the influence of winds upon pressure.

Both hypotheses stand the test of observations, and the last in particular is singularly adapted to extend our knowledge of the nature of barometrical oscillation in Terra Australis.

This influence of winds was detected by Lambert, as far back as 1771. He was the first who suggested the connecting the observation of each wind with that of the barometer. The suggestion was not lost upon the lovers of science. Burckhardt, Ramond, De Buch, Bueck, Dove, Eisenlohr, Kupffer, Schouw, and, lastly, but not least, the enlightened meteorologist Kämtz, directed their attention to the subject, and the results of more than forty years of observations have been such, that, at the localities where they were made, we may infer, with the greatest approximation to the truth, either the height of the barometer from the existing wind, or the quarter the wind is in from the atmospheric pressure.

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* Vorlesungen über die Meteorologie. Lehrbuch der Meteorologie.

Other results, not less important, have been obtained. The observations made in London, Middleburg, and Hamburg, have shown uniformly that the barometer rises during the (N. + N. E. + N. W.) polar wind, and that it falls in the (S. + S. E. + S. W.) equatorial one.

This conquest in meteorology was achieved only by the extreme perseverance with which the observers accumulated the numerical elements, both as regards the wind and the barometer.

In the Australian colonies these elements are as yet too scanty, too imperfect, to yield a result similar to that obtained in Europe; but, trifling as they are, they nevertheless tend to show that the atmospheric pressure in New South Wales and Van Diemen's Land is influenced by winds, and in the same way as it is in Europe and North America.

In order, however, to detect and appreciate the dependence of one phenomenon upon the other, we must deal, not with the prevailing winds, as illustrated in Table II., but with the great circuit of atmospheric circulation which surrounds the Australian continent, and of which the winds of the five stations are mere off-shoots or eddies.

Taking, then, the diagram Pl. II. fig. 2. of the three winters, we see that the northerly segment of the exterior circulation, proceeding from east to west, had less influence upon the motion of the represented eddy; and, consequently, that the prevailing winter winds in

New South Wales and Van Diemen's Land were the effect of the polar, and not of the equatorial wind.

In the two other diagrams (Pl. III. IV.) we see, on the contrary, that the northerly circulation, moving from west to east, extended its segment further to the southward than the S. E.; showing, not only from the effects of the motion which is ascribed to the eddy, but from its temperature, that the prevailing winds of New South Wales and Van Diemen's Land, although coming from different quarters, are originated by the agency of the equatorial wind.

In accordance with the admirable barometrical observations of Flinders and King, and the conclusions to which they have led, viz., that the (S. E. + S.) polar wind raises the barometer, and that the (N. + N. E.) equatorial depresses it; the abridged table of pressures shows that the barometer in winter, on account of the polar wind, gave a higher mean, and that, on the contrary, in summer, when the prevailing wind belonged to the equatorial circulation, it gave a lower mean; thus, not only rendering evident the influence of particular winds on atmospheric pressure, but showing farther, that their effects in the southern hemisphere correspond with those of the northern, as deduced by Dove and Kämtz; in other words, that *in both, the barometer rises with the polar, and falls with the equatorial wind.*

Independently, however, of these influences, the state of the higher region of the atmosphere, in relation to calm or motion, forms of itself a powerful influence upon pressures, and one which must not be lost sight of in the present case.

The Table I. of the preceding division clearly demonstrates, that in summer the number of antagonist currents and surface winds far exceeds those of winter; that is, that in summer the upper regions are in a state of comparative agitation, and in winter in that of comparative calm.

Now the observation of storms and other meteorological phenomena, tends to establish the fact, that the maximum motion of the air is followed by the minimum, in the range of the barometer; and hence justifies the belief, that the difference in the state of the atmosphere, between the summer and winter, of Table I., formed a concomitant influence in producing a difference in the mean barometrical height for each season of Table IV. V.*

Whether the phenomena associated with barometrical pressure are an effect of the sun's declination, with which, through the medium of winds and currents, they certainly have a connection, or are dependent upon the lunar phases, as stated by Arago, Boussingault, and Rivero, is a question which we must leave to future researches and speculations to answer.

RAIN.

The approach of rain in New South Wales and Van Diemen's Land, as traced through the meteorological concomitants with which it is associated, *is indicated by the southerly current, and the N. and N.W. surface wind;* and seems to result from the refrigerating action of the upper atmospherical circulation upon the lower one.

Owing, doubtless, to the two distinct kinds of winds which proceed from the northern quarter—one of them being the hot wind,—the action of the one current upon the other presents two distinct and characteristic phenomena.

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* The angle of inclination at which the atmospheric circulation strikes the surface of the earth, must be taken into account when summing up the influences upon the barometrical range. Observations which I have collected on this point are still too imperfect to admit of a conclusion being formed; but I hope that, with the improvement of the instrument, which is to ascertain the angles of such inclination, the above influence will soon be rendered evident.

In the case of the meeting of the south current and the hot wind, the richly illuminated and cloudless sky begins, at the outset of the contest, to grow dark to the southward; masses of nimbi are soon seen rising from that quarter, and, as if checked in their onward movement, they advance first in a lateral direction along the eastern and western horizon, and then increase in height. At an altitude of about 15° the nimbi are observed to disperse in detached cirro-cumuli, which also, before reaching the zenith, disappear. The lightning which accompanies the developement of this phenomena is emitted without noise, and in horizontal sheets, of comparatively little brilliance.

But the dispersion of the continually increasing cirro-cumuli, by the hot wind, quickly alters the characters of that wind, and the contact of the two antagonist forces draws to a close: the lower current begins evidently to recede in its upper region; in other words, while maintaining its velocity on the surface of the earth, the upper current causes the clouds to advance in altitude.

The first indication the instruments give of this change, is a decrease in the temperature of the ambient air, a very striking increase in solar radiation, and a fall of the barometer.

The next is the diminution of the tension of vapours, and of solar radiation.

The last is a rise in the barometer and a saturated state of the atmosphere.

This is followed by a gradual commingling of the two currents, out of which proceeds a southerly wind of moderate force, attended with cloudy, warm, and sultry weather, extremely oppressive to the feelings, and very unfavourable to the condensation of the circumambient vapours.

In most cases these changes are succeeded by a calm, with occasional light airs, which shift the mists and clouds from one quarter to another for several days, until they eventually disappear, leaving a parched and withered mark upon the exotic vegetation, and from which even the indigenous plants are not wholly exempt.

When, however, the wind which proceeds from the northern quarter is not a hot wind, the action of the two currents resolves itself into a second phenomenon, characterised by an abundance of rain, and a vertical discharge of electricity, accompanied with thunder.

In Van Diemen's Land this action is gradual: the precipitation of rain is effected by the northerly wind, and is both steady and equal.

The southerly current becomes a surface wind, when all the floating vapours are condensed; and this is succeeded, after a short space, by fine and clear weather. In New South Wales, on the contrary, the action is violent, and the northerly wind being suddenly acted upon by the southerly refrigerating wind, condensation takes place, and the rain descends in floods, accompanied generally by southerly gales.

The absolute quantity of rain, which the combined action of winds and currents produces in the two colonies, is expressed in inches, in the following table, which includes 8730 days of observation, brought to the last term of averages for every season, at each station: —

	New South Wales.			Van Diemen's Land.		
	Port Macquarie.	Port Jackson.	Port Philip.	Woolnorth.	Circular Head.	Port Arthur.
Summer	37·58	24·42	13·25	19·68	11·31	16·94
Winter	25·10	28·00	17·47	29·07	24·11	17·75
Annual quantity	62·68	52·42	30·72	43·75	35·42	44·69
Annual average quantity for each colony	48·60			41·28		

The progress of decrease in the annual quantities of rain from the equator to the pole, and which was made by Arago the subject of a most interesting paper, contained in the *Annales de Chimie*, 1824 and 1825, finds itself well illustrated in the case of Port Macquarie, Port Philip, and Port Arthur, and may serve as an additional evidence of the existence of some laws regulating such decrease. The discrepancies, nevertheless, which are to be met with in the amount of rain of the three stations in Van Diemen's Land must be accounted for by the influence which the winds were shown to exercise upon its condensation: the prevailing winds being different at each station, they must naturally produce a difference in the quantities of rain which those stations receive.

The influence, however, of winds, great as it may be, is not the only one which increases or diminishes the fall of rain: that of vegetation is nearly equal to it. The refrigerating powers of plants, acquired through the nocturnal radiations of heat, and the feeble absorption of the same during the day, is exemplified in the most striking manner by a comparison of the quantities of rain condensed by two mountainous districts,—the one richly wooded, the other but scantily covered with vegetation. Thus, on Middlesex Plains, a dependency of the Circular Head Company (Van Diemen's Land), 2700 feet above the sea, the fall of rain is less than on the Hampshire Hills, which average 1800 feet above the sea; the rich arborescent vegetation which is found on the latter, and the partial barrenness of the former, thus differently influencing the condensation of the floating vapours.

The influence of that vegetation upon the amount of rain is still better exemplified by a comparison of the registers of the two stations of the Van Diemen's Land Company. Thus, at Circular Head, a neck of land which projects into the sea, clear of timber, and under cultivation, it rains less than at Woolnorth, also on the sea coast, and equally exposed to the north, but surrounded by a thick forest of luxurious growth.

Other particulars, extracted from the registers, and relating to rain, may be embraced in the following remarks.

The greatest fall of rain recorded in New South Wales, during twenty-four hours, amounted to twenty-five inches, (Port Jackson). On the western side of the dividing range, however, (Namoy River,) marks of extraordinary floods are found; floating bodies, such as grass, rushes, dried branches and bushes remaining attached to the trees at the prodigious height of ten feet from the ground.

The temperature of the rain, as observed in Van Diemen's Land, is sometimes above and sometimes below that of the ambient air. Thus it appears, from the register, that rain has fallen while the thermometer has been below the freezing point; and also when the dry themometer has indicated a temperature of 75°, and the wet one 68°; the temperature of both receding to 60° after such fall of rain.

The periods of the year when the maximum of rain falls, present, in their monthly and seasonal means, some differences, which as yet cannot be satisfactorily accounted for: thus, the maximum of rain at Port Macquarie takes place during the summer season; while at Port Jackson, Port Philip, Woolnorth, and Circular Head, it occurs during the winter months. Port Arthur, again, which is the southern extremity of Van Diemen's Land, had its maximum for 1838, 1839, 1840, in the summer season; while the maximum for 1841 and 1842 occurred in winter. Its averages, as shown in the above table, render the quantities of each season nearly equal.

The registers moreover exhibit a very remarkable fact, viz., that New South Wales is more plentifully supplied with rain than Van Diemen's Land; the table of averages showing that the annual quantity in the former colony exceeds that in the latter by eight inches. However, owing to its more gradual condensation, the lesser quantity of rain in Van Diemen's Land is a more valuable and beneficial concomitant of the climate than the greater quantity in New South Wales.

As compared with other countries we may now see that, notwithstanding the general outcry about the dryness of their respective climes, New South Wales and Van Diemen's Land are better provided with rain than even England: thus London *, generally noted for its wet climate, has an annual quantity of rain equal to 22·19 inches; while the average which falls upon the surface of a station in New South Wales is 48 inches, and in the sister colony 41 inches, per annum.

EVAPORATION.

The evaporating gauge, alluded to under the head of winds and currents, was registered at Port Stephen by Captain P. P. King, and at Launceston by the

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* Daniell's Essay on the Climate of London.

writer, at nine A. M., at noon, and at three P. M., together with the barometer, thermometer, and psychrometer, and the winds and currents. It was kept isolated on a small stand in the open air, and sheltered from rain and sun. Besides its additional evidences relating to the hot wind, it has furnished other results bearing upon meteorological questions. The most remarkable are, that, under ordinary circumstances, the amount of evaporation in Port Stephen, for any of the six hours included between nine A. M. and three P. M., corresponds with that in Launceston; but, for the eighteen hours between three P. M. and nine A. M., it differs, the evaporation in Port Stephen in this case exceeding, on an average, that of Launceston by one hundredth part of an inch.

The season of the maximum evaporation is summer, that of the minimum is winter. In both seasons, the daily evaporation is greater between noon and three P. M. than between nine A. M. and noon.

Under ordinary circumstances, the evaporation during three hours, whether it be before or after noon, does not exceed 00·070; when, however, the hot wind blows, its amount in Port Stephen reaches 00·120, while in Launceston it is but 00·081 of an inch.

The absolute amount of monthly and annual evaporation in the gauge, expressed in English inches, was as follows: —

LOCALITY.	January.	February.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	December.	Annual Quantity.
Launceston, lat. 41° 5′	4·78	3·71	3·50	1·79	1·64	1·23	0·99	0·90	1·50	2·89	4·00	4·90	31·83
Port Stephen, lat. 34° 46′	4·83	3·80	2·70	2·10	2·72	1·39	1·25	1·11	2·25	3·00	4·38	4·59	34·12

The difference of evaporation between the two localities, separated by 6° 20′ of latitude, amount then to about 2·89 of an inch.

The examination of the register of evaporation and of the hygrometrical state of the atmosphere does not lead to the disclosure of any connection existing between the two phenomena.

The following table shows the extraordinary variation of the rates of the tension of vapours, from which nevertheless uniform quantities of water evaporated.

TENSION OF THE AQUEOUS VAPOUR IN THE ATMOSPHERE, AS GIVEN BY THE PSYCHROMETER, DURING THE TIME OF THREE HOURS.

When no evaporation took place.	When 00·010 evaporated.	When 00·020 evaporated.	When 00·030 evaporated.	When 00·040 evaporated.	When 00·050 evaporated.	When 00·060 evaporated.	When 00·070 evaporated.	When 00·080 evaporated.	When 00·110 evaporated.
·214	·348	·382	·271	·319	·415	·494	·538	·470	·513
.236	·360	·383	·355	·337	·423				
·293	·363	·405	·382	·382	·446				
·294	·381	·427	·398	·398	·448				
·305	·398	·432	·415	·439	·518				
·332	·428	·433	·423	·444					
·335	·444	·468	·433	·459					
·349	·464	·478	·447	·483					
·356	·468	·483	·460	·486					
·358	·485	·486	·480	·527					
·397	·508	·502	·492	·550					
·433	·537	·504	·495						
	·573	·524	·502						
	·596	·550	·540						
		·595	·598						
		·631							
Mean of Tensions.									
·323	·454	·480	·446	·438	·450	·494	·535	·470	·513

Thus, as illustrated in the above table, at ·433 of tension of vapour, the evaporating gauge indicated during the space of three hours, at times no evaporation, at times amounts equal 00·010, 00·020, 00·030, and 00·040.

Again, at ·513 of tension, the maximum of evaporation took place; and at ·508, and ·537, the minimum. Furthermore, in the averages of the rates of tension, no relation to evaporation is perceptible; the numerical means of ·480 and ·470 corresponding to 00·020 and 00·070 of the evaporated quantity of water.

The registered temperature, during the process of evaporation, shows, as may be seen in the following tabular form, that it has no more relation to evaporation than the tension of the aqueous vapour had.

TEMPERATURE OF THE AMBIENT AIR DURING THE TIME OF THREE HOURS. (FAHRENHEIT.)

When no evaporation took place.	When 00·010 evaporated.	When 00·020 evaporated.	When 00·030 evaporated.	When 00·040 evaporated.	When 00·050 evaporated.	When 00·060 evaporated.	When 00·070 evaporated.	When 00·080 evaporated.	When 00·110 evaporated.
45°·5	39°	45°	51°·5	54°	60°	68°	86°·5	92°	117°
46	43	50·5	52	65·5	68·5	89	84·5		
46·5	45	51	54	66	71	87			
47	46	53	55·5	67	71·5	71			
48	48	53	57	69·5	72	82			
48·5	49	54	57·5	70·5	73·5	84			
49	50	55	59	72	74				
50	51	55·5	60	74	77				
51	51·5	56	60·5	76	78				
52	53·5	56·5	61	78	86				
52·5	54	57	63	80	90				
53	54·5	57·5	64						
53·5	55·5	58·5	65						
54	56	59·5	65·5						
55	56·5	60·5	66						
56	57	61	67						
57·5	58	62	68·5						
58	59·5	62·5	70						
58·5	60·5	63	71						
59·5	61	63·5	73						
63·5	63	64	73·5						
66	63·5	64.5	75						
68	64	65	83						
	65·0	65·5							
	65	66							
	65·5	67							
	66	68							
	67	69							
	68	69·5							
	69	70							
	70·5	70·5							
	71	71·5							
	72·5	72							
	73	72·5							
	74	73·5							
	81	74·5							
		75·5							
		85							
Mean. 53·8	60·3	62	64	72	74·6	80	85·5	92	117

Here, as in the preceding table, we see that a temperature of between 60° and 68°, that is, within the range of 8° of temperature, sometimes no evaporation took place; while, on other occasions, quantities equal to one hundredth and six hundredths of an inch were registered.

In casting, however, the averages of the different rates of temperature, the connection of the one phenomenon with the other is obvious. Thus, the average temperature of 53° corresponds to *zero* of evaporation, above which that temperature is seen increasing in proportion to the increase of evaporation.

Finally, the examination of the registers which include evaporation and winds, shows a striking recurrence of the same series of facts under similar circumstances, viz., that no evaporation takes place in *calm*, however favourable the temperature and the hygrometrical state of the atmosphere may be to its process, and that all the maxima, diurnal and monthly, occur invariably during the (N.W., N., and N. E.) equatorial wind, and all the minima of that evaporation during the (S. E., S., and S. W.) polar wind.

From what has been said, it follows —

That the state of the atmosphere in relation to evaporation is very nearly the same in New South Wales and Van Diemen's Land.

That a calm state of the weather, whatever may be its hygrometrical and thermometrical condition, is, by virtue of its *vis inertiæ*, an obstacle to evaporation, as much in the one as in the other colony.

That in neither has the tension of the aqueous vapour any connection with evaporation.

That high temperature, although very favourable to evaporation, does not appear to be, in either colony, sufficient to produce evaporation, or to regulate its amount.

That evaporation, as observed in New South Wales and Van Diemen's Land, is mainly dependent upon the agency of those currents of air which possess either a capacity of absorbing and diffusing vapours, or an electrical condition capable of promoting their dispersion; and, lastly,

That, compared with other localities,—for instance, to London,—the evaporation of Port Stephen and Launceston is by no means excessive; the British metropolis having 25·92, and the mean of Port Stephen and Launceston being 32·67 of an inch.

SOLAR HEAT, AND DIAPHANEITY OF THE ATMOSPHERE.

The observations referring to this branch of meteorology, were made with the view of ascertaining the difference which exists between New South Wales and Van Diemen's Land, as regards—

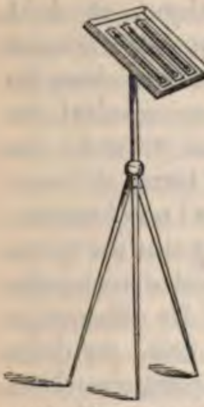
1. *The intensity of solar radiation.*
2. *The calorific effects which solar rays produce by absorption.*
3. *The diaphaneity of the atmosphere.*

In the absence of Sir John Herschell's *Actinometer*, which of all instruments is the best calculated to ensure precision and accuracy, the intensity of solar radiation was obtained by means of a thermometer with a blackened bulb, which was exposed to the action of the sun's vertical rays.

The calorific effects of solar rays were estimated by the difference shown between two thermometers, equally exposed to the action of the rays falling vertically; one theremometer being covered with white, the other with black wool, in corresponding quantities.

The diaphaneity of the atmosphere was ascertained through the means suggested by Arago, viz., the difference between a thermometer screened from radiation, and another covered with swansdown, and exposed, under a perfectly clear sky, at night, to radiate freely towards space.

Of the five thermometers used in the experiments, that with a blackened bulb, and the two covered with wool, were placed permanently in a shallow box screwed to a tripod, as shown in the adjoining wood-cut. The box had both a vertical and horizontal movement. At the top of it, and perpendicularly to its surface, was fixed a common pin, which, by its shadow, guided the adjusting of the box to such a a position as exposed the thermometers it contained to the vertical rays of the sun, and thus dispensed with the necessity of regulating the apparatus by a clynometer.



Independently of the illustration of the colonial meteorology, which demanded this kind of inquiry, I was not the less induced to engage in it from the peculiar interest I felt in the general question relative to the calorific effects which solar rays may produce by absorption in different parts of the world; a question which, about the year 1830, was warmly debated by meteorologists; and has since remained without solution, for want of proper data, or rather, proper method of securing the same.

In the "*Compte rendu de l'Académie des Sciences, séance du* 23 *Novembre*, 1835," this question, and the elements upon which its solution depends, are put in their true light.

In that part of the report which referred to the instructions given to the officers of "*La Bonite*," a

French frigate sent out on a scientific expedition, Arago says:—

"De vives discussions se sont élevées entre les météorologistes, au sujet des effets calorifiques, que les rayons solaires peuvent produire par voie d'absorption dans différens pays. Les uns citent des observations recueillies vers le cercle arctique, et dont semblerait résulter cette étrange conséquence: *le soleil échauffe plus fortement dans les hautes que dans les basses latitudes.* D'autres rejettent ce résultat ou prétendent, du moins, qu'il n'est pas prouvé: les observations équatoriales prises pour terme de comparaison, ne leur semblent pas assez nombreuses; d'ailleurs, ils trouvent qu'elles n'ont point été faites dans des circonstances favorables. Cette recherche pourra donc être recommendée à MM. les officiers de *La Bonite.* Ils auront besoin, pour cela, de deux thermométres, dont les récipiens, d'une part, absorbent inégalement les rayons solaires, et de l'autre, n'éprouvent pas trop fortement les influences refroidissantes des courans d'air. On satisfera assez bien à cette double condition, si, après s'être muni de deux thermométres ordinaires et tout pareils, on recouvre la boule du premier d'une certaine épaisseur de laine blanche, et celle du second d'une épaisseur égale de laine noire. Ces deux instrumens exposés au soleil, l'un à côté de l'autre, ne marquerons jamais le même degré: le thermométre noir montera d'avantage. La question consistera donc à déterminer si la différence des deux indications est plus petites à l'équateur qu'au Cap Horn. Il est bien entendu que des observations comparatives de cette nature, doivent être faites à *des hauteurs égales du soleil*, et par le temps le plus serein possible."

The above instructions have greatly served me in the inquiry undertaken, and have been mainly instrumental to insure, if not a conclusive result, at least a satisfactory procedure.

Thus, the thermometers for showing the intensity and calorific effects of solar rays were observed simultaneously with the motion of the sun, when its declination allowed the altitudes to be ascertained in an artificial horizon: when this could not be done, time, latitude, and longitude were noted, and the altitudes computed by Raper's formulæ.

In the comparison of the different elements thus secured in New South Wales, with those secured in Van Diemen's Land, such of the series only have been compared together in which the *meridional altitude of the sun has corresponded most nearly:* and this indispensable condition, with others, also of paramount importance, such as a clear sky and the absence of wind, has rendered the accumulation of good observations so difficult a task, that out of 120 registered series, only fourteen have been found fit to be compared together and laid before the reader.

They are arranged in seven tabular comparisons, beginning with the series possessing the highest meridional altitude, and closing with those which possess the lowest.

The first column of each table refers to civil time, and that, as will be seen, differs in the compared localities: the difference in days and months was the necessary consequence of its being requisite to obtain equal meridional altitudes of the two localities: the difference in years resulted from various demands on my time to which having other observations to attend I was obliged to submit.

The distance of one station from the other, according to the second column in the four first tables, is equal to 8° 35′ 25″ latitude, and 4° 49′ 5″ longitude. The difference in height above the level of the sea is trifling; that of the station in Van Diemen's Land being fifteen feet, and that of the one in New South Wales being ten.

In the three last tables, the localities at which observations were taken in New South Wales is shifted farther south, and also more to the westward: hence the distance between the two stations is reduced to 6° 7′ 55″ of latitude, and 0° 49′ 5″ of longitude. The difference in the relative height was, however, thus increased; Ellerslie being 1246 feet above Launceston.

The column of the sun's declination shows that such declination is S., and that throughout the instituted comparisons it decreases: its hourly change was noted for the better appreciation of the element which follows: —

TABLE I.

Date, Civil Reckoning, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of the Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1841. Jan. 2. Launceston, Van Diemen's Land.	41 26 5	147 10 55	7 A. M.	– 22 58 20	25 54 28	56°	100°	103°	100°	3°
			8	– 22 58 6	37 6 42	58	101	111	104	7
			9	– 22 57 53	48 16 18	62	113	133	125	8
			10	– 22 57 40	58 52 7	68	128	141	133	8
			11	– 22 57 27	67 39 23	78	136	148	139	9
			12	– 22 57 14	71 31 9	80	141	151	142	9
			1 P. M.	– 22 58 0	67 39 0	81	148	155	146	9
			2	– 22 56 47	58 51 32	75	150	161	153	8
			3	– 22 56 34	48 15 28	73	145	152	145	7
			4	– 22 56 21	37 5 39	72	131	143	136	7
			5	– 22 56 8	25 53 10	72	122	130	123	7
1843. Feb. 10. Port Stephen, New South Wales.	32 40 40	152 0 E.	7 A. M.	– 14 39 25	20 19 38	74	107	119	109	10
			8	– 14 38 37	32 56 4	75	113	125	116	9
			9	– 14 37 48	45 25 9	75	120	130	121	9
			10	– 14 37 0	57 18 39	77	122	134	127	7
			11	– 14 36 12	67 21 10	78	130	138	130	8
			12	– 14 35 23	71 54 43	79	138	146	139	7
			1 P. M.	– 14 34 35	67 19 51	80	140	150	143	7
			2	– 14 33 47	57 16 37	81	135	142	134	8
			3	– 14 32 59	47 22 37	83	123	134	124	10
			4	– 14 32 10	32 52 53	82	113	125	106	9
			5	– 14 31 22	20 15 36	79	111	127	119	9

TABLE II.

Date, Civil Reckoning, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of the Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ″ ′	° ′ ″		° ′ ″	° ′ ″					
1841. Jan. 5. Launceston, Van Diemen's Land.	41 26 5	147 10 55	9 A M.	– 22 40 3	48 5 28	69°	116°	126°	119°	7°
			10	– 22 39 47	58 39 44	70	125	137	129	8
			11	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.
			12	– 22 39 30	71 13 25	78	135	148	139	9
			1 P. M.	– 22 39 14	67 23 41	80	141	151	142	9
			2	– 22 38 57	58 39 9	82	148	158	150	8
			3	– 22 38 40	48 4 37	79	137	149	141	8
1843, Feb. 10. Port Stephen, New South Wales.	32 40 40	152 0 0	9 A. M.	– 14 18 23	45 14 47	79	129	140	131	9
			10	– 14 17 35	57 6 25	79	131	142	139	8
			11	– 14 16 46	67 5 9	79	133	145	137	8
			12	– 14 15 57	71 35 17	80	133	145	137	8
			1 P. M.	– 14 15 8	67 3 48	82	138	150	141	9
			2	– 14 14 19	57 4 20	84	139	148	138	10
			3	– 14 13 30	45 12 11	80	123	137	136	11

TABLE III.

Date, Civil Time, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1841. Jan 8. Launceston, Van Diemen's Land.	41 26 5	147 10 35	9 A. M.	– 22 18 12	47 52 9	61°	117°	129°	121°	7°
			10	– 22 17 52	58 24 32	70	122	131	123	8
			11	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.
			12	– 22 17 32	70 51 27	80	140	155	146	9
			1 P. M.	– 22 17 12	67 4 40	80	145	160	151	9
			2	– 22 16 52	58 23 51	81	145	157	150	7
			3	– 22 16 32	47 51 5	79	141	151	144	7
1843. Feb. 12. Port Stephen, New South Wales.	32 40 40	152 0 0	9 A. M.	– 13 58 37	45 4 12	76	126	140	132	11
			10	– 13 57 47	56 53 51	80	130	143	137	11
			11	– 13 56 57	66 48 42	81	132	145	137	8
			12	– 13 56 7	71 15 27	82	134	146	138	9
			1 P. M.	– 13 55 17	66 47 15	83	135	147	132	9
			2	– 13 54 27	56 51 42	85	131	141	130	9
			3	– 13 53 37	45 1 30	81	131	140	120	10

TABLE IV.

Date, Civil Time, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1842. Jan. 20. Launceston, Van Diemen's Land.	41 26 5	147 10 55	7 A. M.	– 20 16 34	24 17 21	57°	79°	80°	80°	0°
			8	– 20 16 2	35 30 44	58	101	106	103	3
			9	– 20 15 30	46 35 28	69	114	123	118	5
			10	– 20 14 58	56 56 56	70	120	131	126	5
			11	– 20 14 26	65 17 2	73	131	140	133	7
			12	– 20 13 54	68 47 49	78	145	153	146	7
			1 P. M.	– 20 13 22	65 16 2	82	142	155	147	8
			2	– 20 12 50	56 55 21	80	140	156	147	9
			3	– 20 12 18	46 33 26	77	132	147	138	9
			4	– 20 11 46	35 28 10	72	121	131	123	8
			5	– 20 11 14	24 14 7	69	120	127	122	5
1843. Feb. 19. Port Stephen, New South Wales.	32 40 40	152 0 0	7 A. M.	– 11 36 54	18 47 22	68	110	120	112	8
			8	– 11 36 1	31 23 16	70	119	131	122	9
			9	– 11 35 8	43 44 54	77	124	132	122	10
			10	– 11 34 15	55 19 44	77	129	132	122	10
			11	– 11 33 22	64 47 7	79	132	142	134	8
			12	– 11 32 29	68 51 49	80	134	146	138	8
			1 P. M.	– 11 31 36	64 45 34	83	134	147	138	9
			2	– 11 30 43	55 17 23	83	131	147	140	7
			3	– 11 29 50	43 41 53	82	128	140	139	10
			4	– 11 28 57	31 19 35	79	125	131	122	9
			5	– 11 28 4	18 42 46	77	123	130	123	7

TABLE V.

Date, Civil Time, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1842, Feb. 7. Launceston, Van Diemen's Land.	41 26 55	147 10 55	7 A. M.	− 15 31 24	21 21 2	60°	76°	106°	106°	0°
			8	− 15 30 37	32 33 25	61	100	112	107	5
			9	− 15 29 51	43 26 29	66	117	123	117	6
			10	− 15 29 4	53 20 56	70	125	137	131	6
			11	− 15 28 18	60 58 8	77	130	141	134	7
			12	− 15 27 31	64 0 36	78	142	155	147	8
			1 P. M.	− 15 26 45	60 56 40	80	143	156	147	9
			2	− 15 25 58	53 18 32	79	140	151	142	9
			3	− 15 25 11	43 23 18	79	137	150	142	8
			4	− 15 24 25	32 29 28	75	129	141	134	7
			5	− 15 23 38	21 16 9	74	119	132	125	7
1840, Feb. 26. Ellerslie, New South Wales.	35 19 0	148 0 0	7 A. M.	− 9 10 20	17 29 45	72	105	112	104	8
			8	− 9 9 24	29 39 19	72	113	122	113	9
			9	− 9 8 29	41 24 50	74	114	126	116	10
			10	− 9 7 33	52 7 45	76	123	131	122	9
			11	− 9 6 37	60 25 50	79	135	147	139	8
			12	− 9 5 41	63 46 41	81	140	151	144	7
			1 P. M.	− 9 4 46	60 24 10	81	141	153	144	9
			2	− 9 3 50	52 4 57	86	142	152	142	10
			3	− 9 2 54	41 21 16	85	140	150	141	9
			4	− 9 1 59	29 35 1	81	131	142	133	9
			5	− 9 1 3	17 24 32	80	117	130	121	9

TABLE VI.

Date, Civil Time, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1842. Feb. 10. Launceston, Van Diemen's Land.	41 26 5	147 10 55	6 A. M.	– 14 35 16	9 35 41	55°	70°	76°	76°	0°
			7	– 14 34 28	20 45 5	57	74	101	101	0
			8	– 14 33 39	31 57 1	62	103	110	106	4
			9	– 14 32 51	42 47 34	68	115	137	130	7
			10	– 14 32 3	52 36 48	71	128	141	133	8
			11	– 14 31 14	60 6 23	76	132	145	137	8
			12	– 14 30 26	63 4 21	79	135	150	142	8
			1 P. M.	– 14 29 37	60 4 53	80	144	153	144	9
			2	– 14 28 49	52 34 18	81	144	155	146	9
			3	– 14 28 0	42 44 13	82	140	150	141	9
			4	– 14 27 12	31 52 51	79	132	143	135	8
			5	– 14 26 23	20 39 59	74	122	136	129	7
1840, Feb. 28. Ellerslie, New South Wales.	35 19 0	148 0 0	6	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.
			7	—	—	—	—	—	—	—
			8	—	—	—	—	—	—	—
			9	– 8 23 38	40 56 2	77	123	135	126	9
			10	– 8 22 42	51 34 3	84	125	140	132	8
			11	– 8 21 46	59 45 12	85	130	140	132	8
			12	– 8 20 49	63 1 49	88	138	146	138	8
			1	– 8 19 53	59 43 27	88	142	150	142	8
			2	– 8 18 57	51 31 15	89	140	154	145	9
			3	– 8 18 0	40 52 22	87	139	152	142	10
			4	– 8 17 3	29 8 41	85	137	150	139	11
			5	– 8 16 7	16 59 8	85	137	145	136	9

TABLE VII.

Date, Civil Time, and Locality.	Latitude.	Longitude.	Apparent Time.	Declination of the Sun.	True Altitude of the Sun's Centre.	Temperature in Shade.	Intensity of Solar Rays.	Calorific Effects of Solar Rays.		
								Black Wool Ther.	White Wool Ther.	Difference.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″					
1842, Feb. 11. Launceston, Van Diemen's Land.	41 26 55	147 10 55	7 A. M.	– 14 15 0	20 32 47	57°	70°	77°	76°	1°
			8	– 14 14 11	31 44 21	60	101	112	107	5
			9	– 14 13 22	42 33 46	69	110	131	127	4
			10	– 14 12 33	52 20 58	71	122	131	127	4
			11	– 14 11 44	59 47 43	79	130	145	137	8
			12	– 14 10 55	62 44 0	80	144	152	144	8
			1 P. M.	– 14 10 6	59 46 10	81	143	153	144	9
			2	– 14 9 17	52 18 24	80	140	155	146	9
			3	– 14 8 28	42 30 23	79	135	148	140	8
			4	– 14 7 39	31 40 6	75	127	132	124	8
			5	– 14 6 49	20 27 34	70	120	131	124	7
1840, Feb. 29. Ellerslie, New South Wales.	35 19 0	148 0 0	7 A. M.	– 8 3 30	16 51 59	72	106	114	107	7
			8	– 8 2 34	29 0 10	75	120	130	121	9
			9	– 8 1 37	40 41 47	75	125	133	124	9
			10	– 8 0 40	51 17 22	77	125	134	126	8
			11	– 7 59 43	59 25 9	77	127	140	132	8
			12	– 7 58 47	62 39 47	80	131	150	142	8
			1 P. M.	– 7 57 50	59 23 26	86	140	156	148	8
			2	– 7 56 53	51 14 32	85	141	153	144	9
			3	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.	Cloudy.
			4	—	—	—	—	—	—	—
			5	—	—	—	—	—	—	—

The results of the above numerical elements may be summed up in the following terms: —

At equal meridional altitudes of the sun, the diurnal maximum of the intensity of solar rays is greater in Van Diemen's Land than it is in New South Wales.

In both the colonies the diurnal increase and decrease of such intensity has a different developement. Until 9 A. M., the increase of solar intensity in New South Wales is sudden and abrupt, and greatly exceeds in degree that of Van Diemen's Land. From 9 o'clock, however, the increase developes itself more rapidly and attains a higher degree in Van Diemen's Land than it does in New South Wales. In both colonies the increase of the intensity equally follows the increase of the sun's altitude from morning till noon; from noon till 2 or 3 o'clock, the intensity and the motion of the sun are in an inverse relation to each other; that is, as the sun is decreasing in altitude, the intensity increases.

The numerical elements further show that at equal meridional altitudes the diurnal maximum of the calorific effects which solar rays produce by absorption are greater in New South Wales than they are in Van Diemen's Land.

Again, the developement of such effects from morning till noon in one country, is the reverse of that which takes place in the other; that is, while in New South Wales the calorific effects are decreasing from 8 A. M. till 12, in Van Diemen's Land they are on the increase.

In the tables for both the colonies, the effects of solar rays do not show any relation to the altitude of the sun.

The application of the above results to farther inferences is singularly modified by the elements relative to the diaphaneity of the atmosphere in the two countries.

The observations connected with the inquiry into that diaphaneity, show that the difference between the thermometer covered with swansdown, and the non-radiating one, averages in winter, in New South Wales, 4·3 of a degree, and in Van Diemen's Land, 2·2.

They further show, that in summer the average difference between the two thermometers is in Van Diemen's Land 5°, while in New South Wales it is but 3°; and hence that the diaphaneity of the atmosphere at night is, in the two colonies, inverse to their respective seasons, being greater in New South Wales during the winter, and in Van Diemen's Land during the summer months.

Now the summer nights in Van Diemen's Land being clearer, the terrestrial radiation and its refrigerating action precipitate to the surface all the floating vapours within their reach. With the rising sun the precipitated moisture is reconverted into its elastic form, and *the morning is rendered misty until* 9 *o'clock*, at which hour the vapours being raised higher, and diffused or dissipated, the sky becomes clear and bright.

In New South Wales, on the contrary, the summer nights being veiled by the agency of some imperceptible medium, little or no radiation takes place, and scarcely any dew is deposited: the atmosphere *at sunrise is then found clear and transparent.* At 9 o'clock, at which hour the sea-breeze usually sets in, the degree of that clearness and transparency lessens, owing to the humidity of the air-current; and this continues until 2 P.M., when, the sea-breeze ceasing, the sky gradually re-assumes the appearance it had in the morning.

This difference in the transparency of the medium which intervenes between the surface of each colony and the sun, naturally renders the effect of the rays transmitted to their respective surfaces different also; for we see that misty mornings in Van Diemen's Land, and clear mornings in New South Wales, are marked by a sensible difference in the degree of the intensity of solar rays; whilst again, the dissimilar transparency of the air at noon in the two countries is, by parity of effect, the cause of the startling *numerical* fact, that Launceston, which is farther from the equator, possesses at noon a higher degree of solar intensity than Port Stephen, which is nearer to it.

The same equally helps to explain the results obtained by the two thermometers, the one covered with black, the other with white wool; and which show at the two stations the greatest difference at the hours when the air is most transparent.

From what has been said, it follows then —

That the degree of the intensity of solar rays is greater in New South Wales than it is Van Diemen's Land; but that, owing to the more diaphanous atmosphere of the latter colony, the register of a blackened thermometer there yields higher numerical elements than in the sister country.

That the effect which solar rays produce by absorption is greater in New South Wales than it is in Van Diemen's Land.

And, lastly, that the diurnal diaphaneity of the atmosphere is indicated more sensibly by two thermometers, of which the recipients absorb differently the solar rays, than by a thermometer blackened with lamp-black.

TERRESTRIAL ABSORPTION OF SOLAR RAYS, AND RADIATION OR EMISSION OF HEAT.

Amongst the soils belonging to the two colonies that came under my notice in the course of an agricultural inquiry, there were some upon which, according to the statement of the farmers, all the early crops were invariably injured by frost; while on other soils such injury was never observed to take place.

The examination of their relative situation, subsoil, cultivation, hygrometrical state, and chemical character, gave no clue to the causes of this failure or success of crops.

The experiments, however, which were instituted for the purpose of ascertaining the rate or power of absorption and emission of solar heat possessed by these soils, have been more successful, as they have rendered evident the influence of the physical character of soils, not only upon vegetation, but upon climate.

For the present, we shall limit ourselves to the consideration of the latter influence, and shall briefly advert to the method or principle upon which the experiments alluded to were conducted.

The apparatus used was similar to that already mentioned for ascertaining solar radiation, with this difference, that instead of three, six thermometers were employed, and their bulbs crowned with truncated cones of paper, tightly fitted, and spreading upwards, so as to contain the soils.

To these was added a seventh thermometer, which was naked, and, in the observations on the absorption of heat, was placed by the side of those covered with the soils; while in the observations on the emission of heat, it was suspended below them, under a roof which protected it well from radiation.

The element of the *power of absorption* was deduced from comparing the temperature of a thermometer covered by a soil one-twentieth of an inch in thickness with that of a naked reflecting one ; the degree indicated by the latter being considered as *zero*, and the difference obtained being recorded with a sign of +.

The element of *terrestrial radiation* was arrived at by comparing the temperature of one thermometer, covered by a soil one-twentieth part of an inch in thickness, and exposed to radiation towards space, in a clear night, with that of a thermometer screened from such radiation, the degree of temperature indicated by the latter being considered as *zero*, and the difference obtained * being recorded with a sign of —.

The following table embraces the results of these experiments.

LOCALITY.	Absorption of Solar Heat.	Radiation of Terrestrial Heat.
VAN DIEMEN'S LAND.		
Soil from Mona Vale, the property of W. Kennode, Esq. M.C. - - -	+ 12°·6	— 2°
Ditto - - - -	+ 14·2	— 0·5
Ditto - - - -	+ 9	— 4
Ditto - - - -	+ 9·8	— 4·5
Soil from Brickenden, an estate belonging to W. Archer, Esq. - - -	+ 12	— 3
From the same farm - - -	+ 15	— 8
Soil from Longford, Norfolk Plains -	+ 12	— 6·5
Soil from Circular Head, Van Diemen's Land Company - - -	+ 14	— 3·5
Ditto - - - -	+ 24·7	— 7
Ditto - - - -	+ 27	— 12
Soil from Break-o'-day, Mr. Steiglitz's farm	+ 21	— 6

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* Thus, taking for instance, the observations relating to the absorption of solar heat; if, in the apparatus, soil A showed 134°, soil B 138°, and soil C 140°, and if the reflecting thermometer indicated a temperature of 110°, soil A was then registered as having + 24° of absorbing power, soil B + 28°, and soil C + 30° of such power. Again, as regards the emission of heat, if the thermometers covered with soil A showed 57°, soil B 59°, soil C 60°, and the non-radiating thermometer indicated the temperature of 63°, then the power of terrestrial radiation of soil A was registered —6°; that of soil B, — 4°; and that of soil C, — 3°. This investigation into the physical properties of soils was made between 1839 and 1843, in New South Wales and Van Diemen's Land. On my return to Europe, in 1844, I met, in the work of Boussingault, which deserves the greatest attention of agriculturists, with similar investigations, which had been undertaken prior to mine, by Dr. Shübler, *with the exception, however, of terrestrial radiation.* The methods by which our respective experiments were conducted differ: the results are the same, which to me, unaware as I was of Dr. Shübler's labours, is a source of some satisfaction.

LOCALITY.	Absorption of Solar Heat.	Radiation of Terrestrial Heat.
VAN DIEMEN'S LAND.		
Soil from Malachite, the property of the Hon. Mr. Talbot	+ 26°	− 16°
Ditto	+ 26	− 14
Soil from Quamby, the property of Richard Dry, Esq.	+ 10·5	− 0·4
Ditto	+ 14·9	− 6
Soil from Bothwell, the property of A. M'Dowell, Esq.	+ 11·8	− 4
Ditto	+ 15	− 8
Soil from Glen Leith, the property of D. Jamieson, Esq.	+ 14	− 1·5
Ditto	+ 19	− 2
Soil from a farm of Mr. Whittle's, on the North Esk river	+ 18	− 4·5
Soil from Franklin Village	+ 20	− 8
Soil from a farm called Point Effingham	+ 10	− 4
Soil from the northern littoral of Van Diemen's Land, east of the Tamar	+ 15	− 5
Soil from a farm at Cape Portland, tenanted by Mr. Bowen	+ 10	− 4
Soil from a farm on St. George's river, property of the Hon. Mr. Talbot	+ 12	− 5
Average soil from the upper country of Van Diemen's Land, called Lake county	+ 12	− 3
Soil covering the western shores of the river Huyon	+ 16	− 2
Soil from one of the small farms of De la Reyne	+ 18	− 7
Average soils from Macquarie Harbour	+ 10	− 5
Ditto	+ 9	− 5
Port Davy	+ 8	− 4·5
Ditto	+ 8	− 4
St. George's or St. Helen's river	+ 7	− 4·2
Ditto	+ 9	− 5·5
Ditto	+ 7	− 4·2
SOILS BELONGING TO NEW SOUTH WALES.		
From Strout, a farm of the Agricultural Company	+ 14	− 4
Ditto	+ 11	− 2·5
Briton Coast farm, belonging to the A. A. C.	+ 7	− 2
Ditto	+ 12	− 4
Ditto	+ 11·7	− 3
Ditto	+ 6·6	− 3·5
Ditto	+ 14	− 2·5

LOCALITY.		Absorption of Solar Heat.	Radiation of Terrestrial Heat.
NEW SOUTH WALES.			
Vale of Clywd farm, belonging to Mr. Collet		+ 15°	− 6°
Mount Tomah farm, belonging to Capt. Towns - - - -		+ 13	− 3
Boree farm, belonging to Capt. Ryan -		+ 6	− 3·5
Kirringdon Ponds, a farm to the westward of Mount Wingen - - -		+ 10	− 4
Soil covering a large portion of the flats of New South Wales - - -		+ 11	− 8
Soils representing the average soil of pastoral lands in the counties of —	Cumberland -	+ 7·5	− 4
	Ditto - -	+ 8	− 5
	Northumberland	+ 6·6	− 4
	Ditto - -	+ 9	− 4
	Cook - -	+ 7	− 3
	Ditto - -	+ 5	− 3
	Philip - -	+ 9	− 5
	Ditto - -	+ 10	− 6
	Bligh - -	+ 8	− 4
	Ditto - -	+ 6	− 4
	St. Vincent -	+ 7	− 3
	Ditto - -	+ 5	− 3
	Murray - -	+ 5	− 2·5
	Ditto - -	+ 6	− 3
	King - -	+ 8	− 3·8
	Ditto - -	+ 10	− 5·2
	Argyle - -	+ 14	− 4·2
	Ditto - -	+ 12	− 2·8
	Cambden -	+ 18	− 5
	Ditto - -	+ 16	− 3
	Durham - -	+ 17	− 4
	Ditto - -	+ 15	− 4

All the soils, specified in the above table, which have a low absorbing power, and a high radiation, are formed from the disintegration of siliceous rocks, *i. e.* quartz rock, granite, gneiss, protogene, hyalomicte, sienite, siliceous slate, mica slate, petrosilex, porphyry, sandstone, and conglomerates.

The soils, again, which have a high absorption and low radiation, are those derived from greenstones, basalts, trachytes, and serpentinous rocks.

Now, by recurring to the Geological and Mineralogical Section, we shall find, from the proportion which these two kinds of soils bear to each other, in the two colonies, that, on every 100 square miles, New South Wales has 97·56 of siliceous, and 2·43 of pyroxenic rocks; and that Van Diemen's Land, on the contrary, possesses, on every 100 square miles, twenty-five of the first, and seventy-five of the second kind of rock.

From this difference in the rocks composing the crust of New South Wales and Van Diemen's Land, it follows naturally that the calorific effects of the great luminary will be different; and that, considered abstractedly, the reflected heat and high radiating power of the surface in New South Wales must cause an oppressively high temperature during the daytime, and an insufferably cold one during the night; while in Van Diemen's Land, the different mediums must render the nights too warm to be refreshing, after the day's heat.

The wise adjustment of the climatic agencies obviates admirably the inconveniences that would otherwise be felt in such climates.

The influence of vegetation, to which allusion will be made in the next division of this section, and which, owing to the difference of soils, is different in the two colonies, modifies singularly the radiation of their respective surfaces.

Again, the diaphaneity of the atmosphere in Van Diemen's Land, which is superior to that of New South Wales, as greatly checks the emission of heat in one colony, as it favours it in the other.

In some cases, the difference in the relative powers of absorption and emission of heat possessed by a surface, is an influential concomitant of meteorology, not only affecting the mean temperature of a locality (to which reference will be made hereafter), but pointing also to the causes of the extraordinary anomalies which the irregular variation of its barometer presents. Thus, for instance, during the time of my exploring the extreme north-west point of Van Diemen's Land, the barometrical fluctuation at Woolnorth, during twenty-four hours, amounted to 01·600; the maximum occurring during the twelve hours of the day, and the minimum during those of the night.

At Circular Head, on the same parallel, twenty-four miles distant, the daily range of oscillation was = 00·150; the maximum and minimum occurring indiscriminately in both the one and the other period of the twenty-four hours.

Now upon inquiring into the physical character of the soils belonging to these localities, I found that, while the soils of Circular Head possessed a greater power of absorption of solar heat, those of Woolnorth had a greater power of terrestrial radiation; or, in other words, that the absorption and emission of heat in the one locality stood in an inverse ratio to the absorption and emission of heat in the other; thus producing daily, as regards temperature and currents, a diametrically opposite effect; which may, without detriment to any theory of barometrical oscillation, account for the irregular variations of pressure.

But, independently of these considerations, the observations of the physical character of soils give results somewhat at variance with certain axioms in physics. They are presented here, as furnishing some additional data bearing on the interesting and obscure question, as to whether the absorbing power of bodies, in respect to heat, is in direct ratio to their radiating power; or, whether terrestrial absorption and radiation follow different and independent laws.

DEW, AND MOISTURE OF THE ATMOSPHERE.

The relative amount of dew condensed in New South Wales and Van Diemen's Land was a subject of four years' inquiry, and was ascertained by means of twenty grains of perfectly dry wool, exposed in a clear summer night to terrestrial radiation, and by comparing the increase of weight which such wool gained in a certain time, in one country, with that which it gained within an equal time in the other.

The result of this inquiry proved, that while, on an average, the wool in New South Wales, in the summer months, gained five grains, in Van Diemen's Land, in the corresponding months, it gained nine grains; consequently, that the relative amount of dew, in New South Wales and Van Diemen's Land, during a given number of summer nights, will be as 1 : 1·8, a proportion which the preceding notice of the diaphaneity of the atmosphere fully accounts for.

Further observations, connected with dew, disclosed the fact, that on comparing the number of clear nights during the summer months, when alone a deposition of dew can take place, it was invariably found that the number of such nights in New South Wales was, to that of the nights in the sister colony, as 1 : 2·2.

The register of the psychrometer illustrates still further the condition of the two colonies in respect to dryness and moisture: the instrument was observed three times per day, during a period of two years, both in New South Wales and in Van Diemen's Land.

The tension of vapour at the dew point, the register of which is here offered in a condensed form, was deduced by the formula,

$$f = f' - \cdot 0114\ (t - t');$$

in which t denotes the temperature of the air, as shown by the dry thermometer; t' the temperature indicated by the wet; and f' the tension of aqueous vapour at the temperature t'.

TENSION OF THE AQUEOUS VAPOUR IN NEW SOUTH WALES AND VAN DIEMEN'S LAND.

	Date.		Mean Monthly Tension.	Mean Seasonal Tension.	Mean Yearly Tension.
Colony of New South Wales.	Summer	January	00·520	- 00·458	- 00·402
		February	00·450		
		March	00·420		
		October	00·425		
		November	00·456		
		December	00·479		
	Winter	April	00·410	- 00·346	
		May	00·360		
		June	00·330		
		July	00·270		
		August	00·310		
		September	00·398		
Colony of Van Diemen's Land.	Summer	January	00·415	- 00·430	- 00·374
		February	00·447		
		March	00·415		
		October	00·412		
		November	00·450		
		December	00·444		
	Winter	April	00·331	- 00·319	
		May	00·329		
		June	00·293		
		July	00·282		
		August	00·340		
		September	00·342		

The conclusions which were brought forward under the heads of Rain and Evaporation, tend to establish the fact, that the quantity of rain and of evaporation, or, more correctly speaking, the power of the atmosphere to evaporate a certain quantity of water in a given time, is in New South Wales equal to that which exists in Van Diemen's Land.

On comparing, however, the relative amount of dew obtained in the two colonies, and particularly on comparing the means of the above table, it is evident that, notwithstanding the equal share of rain and equal power of evaporation, New South Wales is drier than Van Diemen's Land.

Whence then does this difference arise? The question is of very easy solution.

As stated in the foregoing division of this section, the geological survey proved that, on each 100 square miles, New South Wales possesses 97·56 of siliceous, and 2·43 of pyroxenic rocks; and that Van Diemen's Land, on the contrary, possesses, on every 100 square miles, 25 of the first, and 75 of the second kind of rock.

Now the difference which is observed to exist in the proportions of the kinds of rocks that form the crust of each of the colonies, naturally influences the composition of the soils, and renders their power of production different, as also the action upon the climate of such vegetation as corresponds to that power.

For it is observed that, in Van Diemen's Land, soils formed by the disintegration of greenstones, basalt, and trachyte give rise to a vegetation characterised by lofty trees, ferns, close-tufted *graminæ* and mosses, which contribute to screen the rain-water imbibed by the soil from evaporation; while, in New South Wales, the soils, derived from granitic rocks and sandstones, yield a shadeless vegetation of *Eucalyptæ* and thin *graminæ;* which being incapable of producing the same effect, the rain-water is returned to the atmosphere and carried away by winds.

Again, the difference in the vegetation produces a difference in the solar action upon the surface.

In New South Wales, where, from the physical character of the soil, the absorption of solar heat ought to be less than in Van Diemen's Land, it is virtually greater, as the soils of Van Diemen's Land, with all their high power of absorption, are screened by vegetation from exercising that power; while those of

New South Wales, though possessing that power in a lower degree, are left open to a free and continuous access of solar rays.

The terrestrial emission of heat in New South Wales was likewise proved to exceed that of Van Diemen's Land. The interference of vegetation, however, modifies this tendency, and produces an effect contrary to that which might be expected.

Indeed, the terrestrial radiation in Van Diemen's Land, owing to the influence of vegetation, lowers the temperature of the ambient air in such a degree as to produce, whenever the atmosphere is clear, a copious condensation of the floating vapours in the form of a shower, (as on high mountains, when the passing clouds are within the altitude of their refrigerative action,) or in the form of dew, if no unfavourable circumstances intervene to prevent its deposition.

Such condensation is never observed in New South Wales; and it was owing to the dry air of the night that, during two years of my wanderings in that country, I dispensed entirely with a tent; while, inured as I was to climatic changes, I could not do without one in Van Diemen's Land.

To not taking into account the influence of vegetation, may be ascribed the conflicting opinions of meteorologists with respect to the moisture of the higher regions of the atmosphere; some pronouncing it to be drier, some again, to have the same degree of moisture as the lower. Questions of this nature can only be decided by aeronauts; as, at certain elevations, barren, naked, and reflecting the solar heat, the hygrometrical observations collected, will corroborate the conclusions of De Luc, Saussure, and Humboldt, that the higher regions are drier; while, at elevations, again, which are clothed with a vegetation corresponding to that of the plain or foot of the mountain, the indication of the hygrometer will be the same as there, and will confirm the results obtained by Kämtz, Martin, and Beauvais.

If, however, the elevated locality be that of the Cordillieras at the *passo* from St. Juan to Acongagua (9000 feet), or of the region of Mouna Roa, Sandwich Isles (8000 feet), or of Mount Kosciuszko, New South Wales (5000 feet), or of the table land in Van Diemen's Land (4000 feet), or of Corcovado in Rio Janeiro, before it was clear of timber,—at which altitudes the vegetation is richer than it is on the sea-level,—the hygrometrical results will not agree with either of the above conclusions. In 1841, when the drought destroyed the herbage in the lower part of Van Diemen's Land, the table land of that island furnished throughout the season a most excellent pasture for sheep and cattle.

But, independently of the action of soils through the medium of their vegetation, it has been further observed, that when denuded even of that vegetation, they still possess a direct power of influencing the moisture of a country.

Under the preceding head it was stated that the classification of soils, by the farmer, into "*cold* and *warm*," induced an inquiry which ended in determining their relative power of absorption and radiation of heat.

In the present case, also, it was the farmer's having frequently pointed out two paddocks, situated on the same level, both equally drained and cultivated, and one nevertheless possessing a soil drier than the other, that prompted an investigation which proved that soils are endowed with a property of absorbing moisture from the atmosphere, independently of that of the dew; and that this power, which will be called, in the Agricultural Section, "capacity for moisture," varies *ad infinitum*.

Thus, 100 grains of one kind of soil, dried at a temperature of 212°, and 100 grains of another kind, equally dried, and both exposed to a free circulation of night air, when the wet and dry thermometer indicate nearly the same temperature, both also equally screened from radiation, will show, next morning, a difference in weight amounting to 30 or 40 grains.

Again, on being exposed to the sun with the collected moisture, and reweighed after two or three hours of such exposure, they will show that the emission of moisture is in an inverse ratio to the power of absorption; that is, that the soil which absorbed the most will lose the least, and *vice versâ*.

The chemical analysis, as will be shown in the proper place, proves, that in such cases the aluminous earth of both the soils was in equal quantities; but that, whenever the soil was found drier, it was deficient in the base of humic acid; and whenever it was moist and retentive of moisture, it had of that base from 20 to 40 per cent.

Now, the indigenous vegetation of Van Diemen's Land, promoted by the kinds of rocks which form the soil, is more favourable than that of New South Wales to the accumulation and decomposition of vegetable matter, which constituent of the non-cultivated soils plays so prominent a part in the effects of solar heat and moisture. And while this, in connection with vegetation, tends to explain the difference in the condition of the atmosphere, as regards moisture, it tends not less to justify my humble observations transmitted to His Excellency Sir George Gipps, and published in the Parliamentary Papers of 26th August, 1841; and in which I took the liberty of pointing out the bad consequences which would accrue to the colony from the doing away with vegetation, by overstocking the pasturage, or by burning it,—a practice which, far from improving the grass, as some have imagined, only subtracts from the soil the most essential conductor of moisture, or medium of condensing it in the form of dew or shower.

Whatever difference may exist between New South Wales and Van Diemen's Land in respect to their hygrometrical condition, certain it is that each of these colonies possesses a greater amount of moisture than that which is commonly allotted to them: thus, taking, for instance, the climate of London, as illustrated by Professor Daniell, in his Meteorology, we see that the mean amount of its moisture, represented by ·341 of tension of vapour, is, within a trifle, similar to that of Van Diemen's Land, the moisture there being equal to ·374.

TEMPERATURE.

When it is considered what powerful adjuncts of calorific and frigorific influences are the winds, currents, rain, evaporation, radiation, absorption, and emission of heat, &c., it cannot be wondered at that temperature — alternately cause and effect, acting and reacted upon by the ever-changing and modifying agencies of the atmosphere and the crust of the globe — should seem to be viewed by many as embracing all that is comprehended in the word "climate."

Nor is it to be wondered at, that, in presence of such interferences, connections, and dependencies, the investigation of temperature in the abstract, or "solar climate," should have eluded the ingenuity of meteorologists. The high importance which Arago has attached to the registering of the thermometer, as being capable of yielding elements for the solution of the question of terrestrial temperature, and the permanency of solar heat, refers to the observations secured and accumulated at sea, where the temperature being least influenced by other climatic concomitants, is alone capable of yielding the desired results.

The observations of temperature made on land have a more humble aim in view, namely, the interests of agriculture, to which they are capable of rendering as important assistance as that which is furnished by chemistry. To the colonies of New South Wales and Van Diemen's Land, where the spirit of enterprise and industry leads the settlers to study the amelioration of the exotic vegetation and breeds of animals, meteorological observations generally, and the knowledge of thermometrical means in particular, will be of most essential service. Thus, if he know the kind of soil, and the mean temperature of Montpellier, Xeres, Malaga, or Oporto, a settler in New South Wales may decide whether the vine or olive tree of those localities is adapted to his own vineyard or orchard. Again, such knowledge may lead him to the introduction of the *Alpacca* from Peru, or may in some measure be instrumental in correcting the erroneous and unprofitable system which he had previously pursued, of breeding cattle in a locality of a higher winter mean than that from which they were orginally imported.

The colony of New South Wales furnishes, for the deduction of its thermometrical condition, three registers, kept for the three years ending with 1842. Reduced to the last term of their means, these registers give, in degrees of Fahrenheit's thermometer,—

For Port Macquarie.

Summer.	Maximum of temperature	88°·3	Annual mean, 68.
	Minimum	61·8	
	Fluctuation	26·5	
	Summer mean	75·0	
	The warmest month, November.		
Winter.	Maximum of temperature	75·3	
	Minimum	46·8	
	Fluctuation	28·5	
	Winter mean	61·0	
	The coldest month, August.		

For Port Jackson.

Summer.	Maximum of temperature	81°·9	Annual mean, 66·6.
	Minimum	59·0	
	Fluctuation	29·9	
	Mean for the season	73·9	
	The warmest month, November.		
Winter.	Maximum of temperature	73·3	
	Minimum	45·3	
	Fluctuation	28·0	
	Mean for the season	59·3	
	The coldest month, July.		

For Port Philip.

Summer.	Maximum of temperature	90°·6	Annual mean, 61·3.
	Minimum	48·8	
	Fluctuation	41·8	
	Mean for the season	69·4	
	The warmest month November.		
Winter.	Maximum of temperature	69·8	
	Minimum	36·9	
	Fluctuation	32·9	
	Mean for the season	53·3	
	The coldest month, July.		

The three stations of the colony of Van Diemen's Land furnish registers of temperature for five years, ending with 1842; to which is added my own register, kept in Launceston for one year. Abridged, in a manner similar to the former, these registers give the following results:—

FOR WOOLNORTH.

Summer.	Maximum of temperature	68°·7	Annual mean, 57·4.
	Minimum	52·9	
	Fluctuation	15·8	
	Mean of the season	60·8	
	The warmest month, January.		
Winter.	Maximum of temperature	62·0	
	Minimum	46·3	
	Fluctuation	17·7	
	Mean for the season	54·1	
	The coldest month, August.		

FOR CIRCULAR HEAD.

Summer.	Maximum of temperature	75°·0	Annual mean, 59·7.
	Minimum	56·2	
	Fluctuation	18·8	
	Mean of the season	65·6	
	The warmest month, January.		
Winter.	Maximum of temperature	63·4	
	Minimum	44·4	
	Fluctuation	19·0	
	Mean of the season	53·9	
	The coldest month, September.		

FOR LAUNCESTON.

Summer.	Maximum of temperature	68°·4	Annual mean, 59.
	Minimum	49·0	
	Fluctuation	19·4	
	Mean for the season	66·0	
	The warmest month, February.		
Winter.	Maximum of temperature	56·0	
	Minimum	41·4	
	Fluctuation	14·6	
	Mean for the season	53·0	
	The coldest month, June.		

FOR PORT ARTHUR.

Summer.	Maximum of temperature	78°·3	Annual mean, 57·9.
	Minimum	46·8	
	Fluctuation	31·5	
	Mean of the season	62·5	
	The warmest month, December.		
Winter.	Maximum of temperature	66·5	
	Minimum	38·2	
	Fluctuation	28·3	
	Mean of the season	53·3	
	The coldest month, August.		

The difference in latitude between Port Macquarrie, the farthest northern station, and Port Arthur, the extreme southern, being = 11° 45′, the difference between their respective annual means of temperature will be = 10·1; and hence the change of temperature on every minute of latitude is = 0·01432624 of a degree of Fahrenheit.

Now, by reducing the annual means of the intermediate stations to this ratio of change of temperature, and by comparing such reduction with the means of actual observations, we obtain a test of the accuracy of the registers.

Locality.	Latitude.	Longitude.	Means from Observation.	Means from Reduction.	Difference.
Port Macquarie	31° 25′	152° 56′	68°·00		
Port Jackson	33° 51′	151° 18′	66·60	65°·05	−1·53
Port Philip	38° 18′	144° 38′	61·30	61·23	−0·07
Woolnorth	40° 42′	144° 43′	57·40	60·08	+2·63
Circular Head	40° 40′	145° 20′	59·70	60·05	+0·35
Launceston	41° 26′	147° 10′	59·00	59·36	+0·36
Port Arthur	43° 10′	148° 6′	59·90		

The differences between the computed and observed means, far from invalidating the observations, do but show the local thermometrical anomalies of each station in a more prominent light, and corroborate what, otherwise, a mere knowledge of the localities would have led to be supposed.

Thus, the station of Port Jackson, situated on a naked cliff of sandstone, exposed to higher calorific effects of solar radiation than the two extreme stations, possesses, consequently, a higher annual mean than that which the ratio of change of temperature between Port Macquarie and Port Arthur assign to its latitude. Woolnorth, on the contrary, being on the level of the sea, surrounded by a thick underwood vegetation and marshy grounds, and thus exposed to an increased frigorific influence, has, and by parity of reasoning must have, its actual mean lower. When, however, the difference between the two annual means is slight, as in the case of Port Philip, Circular Head, and Launceston, the local condition of such stations and the two extreme ones are alike.

The annual means of the above stations suggest another reflection. The abstract shows that Port Arthur and Circular Head are isothermal: on the examination however of their registers, a most material difference in other circumstances of temperature is observed. They differ in maxima and minima; and the fluctuation of temperature at Port Arthur, is both in winter and summer, nearly double that of Circular Head; thus showing that the annual mean of a locality — upon which so much stress is commonly laid — is, by itself, an element of no value, and is far from conveying a correct idea of the temperature to which it refers.

By comparing the thermometrical condition of the above seven stations with that of various localities in the northern hemisphere, we shall see that the temperature of the former is more admirably adjusted *than any with which they may be put in juxtaposition:* the fluctuations, for instance, of St. Petersburgh are 57°; of Warsaw, 43·2; Vienna, 43°; Buda, 44°; Milan, 38·4; Zurich, 38·9; Copenhagen, 38·9; Philadelphia, 43·3; New York, 55°; Quebec, 59·6; — whereas the highest annual mean of such fluctuation at Port Philip amounts only to 37·3!

Other facts, which the examination of the registers furnish, are —

1. That the temperature between eight and nine o'clock, A.M., in summer, and between nine

and ten, A.M., in winter, represents the daily mean of each season.

2. That the minimum of temperature of summer is equal to the mean temperature of winter.
3. That the maximum of winter corresponds to the mean of summer.

CONCLUSION.

To this rapid and imperfect sketch of the prevailing constitution of the atmosphere, as regards winds, currents, atmospheric pressure, rain, evaporation, radiation, absorption, and emission of heat, dew, moisture, and, finally, temperature, a brief recapitulation of the main evidences is added, in order that the climatic concomitants to which they refer, being placed in nearer and more prominent relation to each other, may the better illustrate, whether by comparison or otherwise, the climate to which they belong.

The Australian winds and currents, considered in relation to the main effects they produce on pressure, moisture, and temperature, have been shown to possess a striking analogy to the winds and atmospheric currents of Europe and other parts of the world; which, consequently, renders the conclusion plausible, that their constitution and agencies possess nothing peculiar or exceptive, by which these winds could be viewed as characteristic of the zone to which they belong. The hot wind, even, was found to resemble similar winds in Asia (Jakoutsk), Africa, North America (Lower California), South America (Acatama), and the Indian Archipelago, with this remarkable difference, that its short duration, not exceeding ten hours, and its rare occurrence, which takes place but twice or thrice per annum, prevent in a great measure the extent of mischief and injury to which the above-named parts of the globe are exposed.

Thus, while in Asia and Africa the hot wind forms a concomitant of the climate, in New South Wales and Van Diemen's Land it must only be classed amongst the extraneous agents which casually disturb a well-ordered climatic economy, as do those winds in the south of Europe known under the names of Sirocco, Mistral, &c.

As regards rain, it was proved to be more plentiful in New South Wales than in Van Diemen's Land,—a startling fact, to those acquainted with the localities, but which, based on numerical elements furnished by six different stations, is undoubtly correct. Both the colonies, as compared to England, have been shown to receive a larger amount of rain than does Brussels, Berlin, Geneva, York, and, lastly, London, so celebrated for its humidity.

Further, as regards evaporation, the fact was clearly made out, that water exposed to evaporation, under similar circumstances, will lose, whether in the monthly or annual amount, nearly the same quantity in New South Wales as in Van Diemen's Land; whereby is demonstrated, that the power of the atmosphere, as regards its mechanical resistance to the diffusion of vapours, and its power of influencing the elasticity of such vapours, and consequently of promoting their diffusion, is exactly the same in the two colonies. The absolute amount even of annual evaporation of water, as shown by the register of the evaporating gauge, was found to be very near that which an evaporating dish gives in London.

The observations detailed under the head of Solar Heat, &c., led to the conclusion that the intensity and effects of solar rays are greater in New South Wales than they are in Van Diemen's Land; but that, owing to the difference in the diaphaneity of the surrounding medium, Van Diemen's Land is exposed to a greater intensity of solar rays than New South Wales.

The next division brought to light the existence of still greater modifications of the action of solar rays in the two colonies: it went even farther—it showed, by the elements of the relative power of absorption and emission of heat which soils possess, and by the proportion which the different kinds of rocks bear to each other, that such is the influence of the geological formation of New South Wales and Van Diemen's Land upon the received amount of solar heat, that, had it not been from other concomitants of climate, the two colonies would have been unavailable to civilisation. But Providence, in its kind dispensation, has modified and adjusted, by means of vegetation and diaphaneity of the atmosphere, this effect of solar heat, and thus put a most admirable check upon the excess of caloric and refrigeration.

Again, under the head of Moisture, the soils, the vegetation, and the diaphaneity of the atmosphere have been shown to possess as great an influence upon the hygrometrical condition of the colonies as that which they so beneficially exercise on the effects of solar heat. By the examination of the numerical elements relative to dew, and tension of vapours, Van Diemen's Land was proved to possess a greater moisture than New South Wales. Both colonies nevertheless, as compared with other countries, show a lower hygrometrical mean than is usually allotted to them: thus Van Diemen's Land was shown to have very nearly the same degree of moisture as London.

As to the colonial temperature, which comprehends so many different climatic effects and agencies, the reader cannot but be struck with the range and favourable thermometrical condition in which every locality illustrated under the head of Temperature is found to be placed, when compared to other localities on the globe.

Port Macquarie, in that comparison, is seen to possess the summer of Florence, Barcelona, Rome, or Naples, the winter of Funchal or Benares, and a thermometrical fluctuation similar to that of Dublin: by its annual mean it may be classed with the climate of Tunis.

Port Jackson, again, is, by a similar comparison, found to have the summer of Avignon (France), Constantinople, Baltimore (United States), or Philadelphia, and a winter very nearly similar to that of Cairo (Egypt), or of the Cape of Good Hope. Its fluctuations correspond with those of Paris, and its annual mean temperature with Messina (Sicily) and the Cape of Good Hope.

Port Philip resembles, in its summer season, Baden, Marseilles, and Bordeaux; in its winter, Palermo or Buenos Ayres: the fluctuations of its temperature are those of Montpellier, and its annual mean is that of Naples.

Woolnorth possesses the summer of Freiberg, Bayreuth, Berne, or Cheltenham, and a winter similar to that of Algiers or Messina: its thermometrical fluctuations are similar to those of Havanah and Cumana, and its annual mean to Madrid and Avignon.

Circular Head is found to have the summer of Kracow, Prague, Lausanne, Würtzburg, Karlsruhe, the winter of New Orleans, and the annual mean of Toulon, and St. Fé de Bagota (South America).

Launceston, in its summer, resembles Manheim, La Rochelle, and Toulouse, and in its winter and its annual mean, Lisbon and Perpignan.

Lastly, we see *Port Arthur*, the extreme southern station of Van Diemen's Land, possessing the summer of Tilsit, Dantzic, Augsburgh, and Jena, and a winter like that of Smyrna.

According, then, to the above, the thermometrical fluctuations assimilate New South Wales and Van Diemen's Land to a tropical region: the summer season of the two colonies resembles the summer of that part of Western Europe which lies between latitude 41° 53′ and 55° 57′, and the winter that part of the Mediterranean which is enclosed between the coasts of Spain, Italy, France, and Algiers, extending to Tunis and Cairo; and thus is concentrated within the space of 11° of latitude the elements of seasons most requisite and essential for exalting all the energies of animal and vegetable life.

Independently, however, of comparison and analogies, the climatic condition of New South Wales and Van Diemen's Land is represented in the most favourable light by its rich *flora*, and by the healthy condition of its aborigines and indigenous animals. Looking, indeed, at the singular and distinctive features by which its organic life is characterised, making this continent as it were a world apart, we cannot but wonder that the same climate under which that life appears should be likewise so well adapted to the maintenance of the vegetation and the animals of other hemispheres. The effect produced by the appearance of the plantain growing in company with the vine, apple, peach, and the English oak,—which is the case at Tahlee, head station of the Australian Agricultural Company,— and these again flourishing in the close vicinity of the *Eucalyptæ* and *Mimosæ*, is indeed surprising; nor is it less surprising to behold the kangaroo, sheep, emu, and the horned cattle roaming together in the same forest, and seeking sustenance from the same herbage.

But what mainly illustrates the fertility and salubrity of both these countries, is the healthiness of the English settlers who have taken root in the soil. No endemic disease, and seldom any epidemic of grave character, prevails; and if individual indisposition, or even partial deterioration of the progeny, is sometimes seen, it is to be traced to the pertinacity with which the English race cling to their original modes of living, wherever they settle, and, however different their adopted may be, to their native climate: it is to the abuse of strong wines, malt liquors, and spirits, and particularly to the excessive consumption of animal food of the richest description, and even to the mode of clothing and housing, that individual diseases, such as dyspepsia, premature decay of teeth, and affection of the brain, may be attributed.

The climate of New South Wales and Van Diemen's Land, farther, has never been shown to have exercised any of those deadly or deleterious effects on the constitutions of the first European emigrants, or of those who have followed them, which many climates, highly vaunted for their excellency, have done.

In that delicious abode, the Island of Penang, there was pointed out to me the talus of a range of the richest growth of nutmeg, coffee, and mangustine trees, blending into a not less luxurious platform of gardens and plantations, but which, before it was brought to its present admirable state of cultivation, cost the lives of thousands of Europeans and natives. The clearing of the talus and the plain from the dense forest caused a sudden access of air, light, and heat, which accelerated the decomposition of the vegetable deposits accumulated for ages, and the consequent disengagement of all the noxious gases most prejudicial to animal life. The West of the United States of North America, nay even the Eastern States, including East shore of the beautiful Hudson itself, are afflicted with the constant presence of fever and ague! On the banks of the Ohio and Mississippi, where the fertility of the soil is great beyond comparison, I still saw it raging, which it will continue to do until the virgin soil shall, by cultivation, clearing, introduction of European flocks, &c., be purged from those noxious elements, which now, in chemical combination with the atmosphere, render the respirable air so prejudicial to human health.

But the climate of New South Wales and Van Diemen's Land, as we see it in the present day, is very different from what it was, before those colonies were brought within the pale of civilisation. Records are wanting to show with certainty the extent of the mutation which civilisation has effected: reasoning, however, from analogous causes and effects, we cannot much err in affirming that the destruction of thick herbaceous underwood *scrubbs*, and thick interwoven forest, must have necessarily rendered the climate drier; just as the 250,000 acres of cultivated land in those colonies, freed from the bad conductors of heat which encumbered their surface, have developed their powers of absorption and radiation, and thus naturally contributed towards the increase of the mean annual temperature.

The climate, however, though both drier and hotter, is far from being improved. A still farther development of the science and industry of civilisation is wanted to check the evils with which the lack of moisture, and the presence of parching heat, threaten the interests of agriculture.

Already the writer's humble remarks, contained in in a Letter to His Excellency Sir John Franklin *, and in which the advantages and facilities of irrigation were pointed out, and the relative heights of lakes and rivers, and of farms suited to such operation, were given, have awakened a noble emulation amongst the settlers of Van Diemen's Land, and the introduction of this potent auxiliary of agriculture has begun on a large scale.

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* See Vol. I. No. 2. of the "Tasmanian Journal of Natural Science, Agriculture, Statistics," &c., published at Hobart Town, under the patronage of His Excellency the Governor, Sir John Franklin.

Some most valuable results have been already attained through its agency; others are still waiting to be developed; but all of them will react most beneficially upon the climate of the colonies, and will thus identify the struggles of the Australian settlers with the most noble conquests of modern times.

SECTION V.

BOTANY.

INTRODUCTION.

HITHERTO, whether directing our inquiry to the geology of New South Wales and Van Diemen's Land, or to their respective climates, we have met invariably with striking instances, either of identity or analogy, by which they are assimilated to Europe and America.

On examining, however, the indigenous organic forms of New South Wales and Van Diemen's Land, we find that they exhibit, in common with the rest of New Holland, a general physiognomy, which is exceptive with respect to the rest of the globe; and that this general aspect or physiognomy is especially remarkable in the peculiar vegetation which pervades the whole of Terra Australis.

Throughout the immense coast line of this continent, the aspect of the vegetation is characterised by a striking dulness and uniformity of hue, arising, according to R. Brown, from its remarkable peculiarity of structure.* The distances over which that vegetation is spread, and the different positions it occupies, produce little change in its external appearance. The course of the seasons even, which in extratropical countries causes the leaves to fall, and diversifies the foliage with the fresh bright verdure of spring or the gorgeous and variegated tints of autumn, has no influence upon the unvaried mantle of olive-green which clothes the forests of Australia.

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* "Quod magis notatu dignum, ob numerum admodum insignem Arborum et Fruticum Australasiæ in quibus pagina utraque pariter glandulis instructa est; cujus structuræ prævalentia, verticali positione et exactâ similitudine paginarum sæpè comitatæ, characterem ferè peculiarem sylvis, præsertim extratropicis, Novæ Hollandiæ et Insulæ Van Diemen, impertit." — *Supplementum Primum Prodromi Floræ Novæ Hollandiæ Præmonenda. Robertus Brown.* Londini, 1830.

On a near examination, however, this vegetation is discovered to possess much gracefulness in the form both of species and of individual trees, and many delicate or minute shades in its verdure, which, combined with the ever changing ash-grey colour of the shedding bark of the *Eucalyptæ*, the undulating and often broken surface upon which it thrives, and the resplendent sky above, present a world of interest and attraction. Frequently, it is so grouped as to exhibit contrasts of surpassing beauty, the more striking because they are abrupt and little expected. Amid the apparent sameness of the forest, may be often found spots teeming with a gigantic and luxuriant vegetation, sometimes laid out in stately groves, free from thicket or underwood, sometimes opening on glades and slopes, intersected with rivulets, carpetted with the softest turf, and which lack only the thatched and gabled cottage, with its blue smoke curling amid the trees, to realise a purely European picture. Sometimes, again, the forest skirts an open country of hill and plain, gracefully sprinkled with isolated clumps of trees, covered with the richest tufted herbage, and enamelled with flowers of varied form and colour; or it is lost in immense thickets, where innumerable flowering shrubs, and elegant interwoven creepers, form bowers as impenetrable and as picturesque as those seen in the forests of Brazil.*

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* Brazil, Sierra Estrella, 1835. — To explore, as it were, the recesses of the magnificent picture which we contemplate from the bay of Rio de Janeiro with an ever-increasing pleasure, to penetrate the

The most striking and predominant trees in these forests are, the graceful fern-trees, the *Casuarinæ*,

ravines, to scale the mountains, to cross the valleys, to force a passage through the virgin forests, which seem to exhale the inspiring atmosphere of the fresh created earth, — to survey there the riches of vegetation and the boundless munificence of nature, — to observe how each hill — each valley, varies in character — how each trunk, branch, leaf and flower has its own peculiar beauty of form and colour, — to examine and to contemplate all this, so strikes the mind with admiration of terrestrial wonders, as to cause it involuntarily to rebound towards its Creator. . . . .

It is more particularly in the forest that the grand and the picturesque, the sublime and the fantastic, form the most singular and happy combinations. From the loftiest giants of the forest, down to the humblest shrubs, all excite the astonishment of the spectator. By means of the parasites, which form the most characteristic feature of the Brazilian forests, every thing seems united in one community of being and of aim. These, at first creeping parasites, soon cling boldly and closely to the tree, climb it to a certain height, and then, letting their tops fall to earth, again take root there, — again shoot up, push from branch to branch, from tree to tree, in every direction, until — tangled, twisted, and knotted in every possible form — they festoon the whole forest with a drapery, in which a ground-work of the richest verdure is variegated with garlands of the most beautiful and many-coloured flowers. Sometimes the parasites choke the tree which they embrace: the latter then decays and falls, while the former remain suspended, attached to the surrounding trees, and constantly increasing in thickness, until they present the appearance of magnificent twisted columns, around which a fresh growth of plants soon rises, turning and clinging with a grace which is indescribable. In no other part of the world is nature so great a *coquette* as here. At every period in the life of plants, her desire to please and to fascinate appears immoderate and unlimited: all that is ugly, melancholy, or repulsive, — all that speaks of gloom, decrepitude, or decay, — is banished: the breath of an eternal spring is maintained throughout the forest; and flowers and fruit, loading the same branch, are presented in constant succession, and in colours ever fresh. If a tree wither, or shed its leaves, or begin to show symptoms of decay, thousands upon thousands of plants climb it, and weave a robe with which to cover its infirm trunk and branches; and having fulfilled this mission, re-descend from the summit, playfully waving their plumes, sporting with and embracing millions of others, which they meet on the way, until at length they lose themselves in the immensity of the thicket. If the tree decays, if it falls overwhelmed with age; nature hastens to conceal the horrors of death. She summons the moss and the lichens to prepare it a bed — she calls forth a thousand parasites to form a pall or covering for the couch. Thus, instead of the uprooted and rotten trunks, which in our forests of North Europe exhibit scenes of naked desolation, we have here only so many gorgeous canopies, surmounting sofas velvetted with the rich and delicate plants which beautify the pines, the Van Diemen's Land sassafras (the *Atherosperma* of Labillardière), the myrtle, the *Banksiæ*, the *Eucalyptæ*, and *Acaciæ*.

Respecting the two latter, R. Brown observes, "that these two genera are not only the most widely diffused, but by far the most extensive, in Terra Australis, about one hundred of each having already been observed; and, if taken together, and considered with respect to the mass of vegetable matter which they contain, calculated from the size as well as the number of individuals, are perhaps nearly equal to all the other plants of that continent. They agree very well also, though belonging to very different families, in a part of their economy, which contributes somewhat to the peculiar character of the Australian forests, — namely, in their leaves, or the parts performing the functions of leaves, being vertical, or presenting their margin, and not the surface, towards the stem, both surfaces having, consequently, the same relation to light.

"This economy, which uniformly takes place in the *Acaciæ*, is in them the consequence of the vertical dilatation of the foliaceous petiole; while in *Eucalyptus*, where, though very general, it is by no means universal, it proceeds from the twisting of the footstalk of the leaf.

"These two genera still more uniformly agree in the similarity of the opposite surfaces of their leaves. But this similarity is the indication of a more important fact, namely, the existence equally on both surfaces of the leaf of those organs which by most

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forest. If examined more closely, if this exquisite carpet be raised, a new world reveals itself; millions of worms, and millions of young plants, are springing from the bed of death, and astonish the eye. Every thing submits here, as elsewhere, to the law of nature; but here only nature conceals all the hideous processes of decomposition, and so embellishes the very shroud of death that it appears to the eye but as the graceful drapery of some festal scene. — *MS. Journal of the Author.*

authors are denominated pores, or *stomata* of the *epidermis*."*

Independent of the described vegetation, the Australian continent, so far as it has yet been brought to light, possessed a flora which differs materially from what we know in the present day of the existing Australian plants, and which lays strong claims to priority of investigation.

FOSSIL FLORA.

These specimens of fossil plants, collected by myself, which arrived without damage in England, are but few: they may be referred to two distinct geological epochs; first, that of the deposition of coal, and the sandstone superincumbent on the coal, of the Jerusalem Basin; and, secondly, that of the formation of the (tertiary) yellow limestone at Hobart Town, which contains impressions of leaves of an unknown vegetation, and a *Helix* and *Bulimus* not as yet identified with any existing forms.

J. Morris, Esq., author of the *Catalogue of British Fossils*, to whom natural history is greatly indebted for his zeal in the promotion of palæontological researches, has kindly undertaken the examination of my Australian specimens, the result of which is now submitted to the reader, in his own words.

" CARBONIFEROUS FLORA.

" SPHENOPTERIS *Brongniart*.

" There is one species of this genus, belonging to the section of which *S. linearis*, *S. elegans*, and *S. trichomanoïdes* are the type; but differing generally from all of them, as regards the arrangement of the pinnulæ. It may be thus briefly characterised:—

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* "Sketch of the Botany of the Vicinity of Swan River," by R. Brown, Esq., F.R.S.; Journal of the Royal Geographical Society, 1830–31., p. 17.

"Frond, furcate, slender; pinnulæ, cuneiform, trilobed, truncate at the apex, and rather distant from each other.

"I have not ventured to give a name or a figure of this species, having only seen a drawing taken by the author of this volume from a specimen in possession of William Breton, Esq., of Launceston, Van Diemen's Land, which exhibits the above characters, but in which the venation is not defined."

Locality.—Jerusalem basin, Van Diemen's Land.

Sphenopteris lobifolia. (Pl. VII. fig. 3. 3*a.*)

"Frond bipinnate; pinnæ, somewhat linear, elongate, alternate; pinnulæ membranous, those of the lower pinnæ equal, ovate oblong, contracted at the base, approximate, with three nearly equal rounded lobes on each side, and a terminal obtuse one; the veins, proceeding into each lobe, divide near the mid rib, the upper one being furcate; the pinnulæ towards the apex of the frond are rather sharply three-lobed and decurrent, the veins becoming furcate in each lobe.

"This appears to have been a very delicate fern: the pinnulæ are very slender, or membranous, and variable in shape according to their position on the frond."

Locality.—Newcastle coal mines, New South Wales.

Sphenopteris alata var. *exilis.* (Pl. VII. fig. 4, 4*a.*)

Syn. Pecopteris alata Brong. Hist. Veg. Foss. i. p. 361.
Aspidites alatus Göppert, Foss. Farn. p. 358.

"Frond somewhat triangular, with a tripinnatifid base; margin of the rachis alate; pinnulæ either contracted at the base or confluent, decurrent, irregularly lobed, lobes entire or dentate; veins slender, pinnate.

"This interesting species of fossil fern appears more nearly related to *Sphenopteris* than *Pecopteris*, and is easily distinguished by the slender and decurrent pinnula and the membranous or alate margin of the principal rachis, as is observed in the recent species of *Hymenophyllum*.

" Associated with the last species and *Glossopteris Browniana* in a light-coloured shale, from Hawkesbury River, New Holland. The museum of the Geological Society contains specimens of the two above-described species."

Locality. — Newcastle basin.

Glossopteris Browniana (Pl. VI., fig. 1. 1*a*.) Brong. Prod., p. 54.; Veg. Foss., p. 223. t. 62.

" Frond simple, spathulate or oblong-lanceolate, entire, attenuate at the base; midrib thick, canaliculate, gradually contracting towards the apex; veins oblique, anastomosing.

" This beautiful specimen of fossil fern appears to be tolerably abundant in the carboniferous deposits of New Holland; and if these beds are of the age of the true coal-measures, it is the more interesting; for, in the northern coal-fields of Europe and America, we have no evidence of the existence of simple fronded ferns with reticulate venation. This species constitutes the type of Brongniart's genus *Glossopteris*, two other species are also referred to this genus, from the oolitic series of Sweden and England; the *G. Phillipsii* from the latter locality, agreeing precisely in its mode of venation with *G. Browniana*, appears, however, not to have been a simple frond, as originally described by Brongniart, but digitate, four or five pinnulæ arising in a flabellate form from a common rachis; in consequence of which, Göppert has arranged it under one of the sections of his genus *Acrostichites*.

" The young or smaller pinnulæ of this fern are generally lanceolate, the larger ones are more spathulate and obtuse; the midrib is large at the base, and gradually contracts to the apex; the secondary veins are distinct, parallel near the base, but soon afterwards become oblique and regularly anastomose. In Brongniart's figures, as well as in the one subsequently copied by Göppert, and also in their descriptions, the veins are mentioned as being only reticulate near the mid rib, becoming simple or furcate as they approach the margin: a careful examination of numerous specimens has convinced me that the veins regularly anastomose between the midrib and margin, as shown in the figure (Pl. VI. fig. 1*a*.), and in Brongniart Veg. Foss. Pl. 62. f. 1. A."

Locality.—Newcastle coal mines, New South Wales.

Pecopteris australis. (Pl. VII. fig. 1, 2. 2*a*.)

"Frond bipinnate; pinnæ oblique, alternate, rather distant; pinnulæ thin, falcate and rather obtuse, oblique and somewhat incurved, more or less adnate to the rachis, and sometimes decurrent, dilate at the base, or auriculate; midrib slightly flexuous, evanescing towards the apex; veins oblique, bifurcate, or dichotomous.

"This fern belongs to the neuropteroid division of *Pecopteris*, and bears much greater resemblance to the *P. Whitbiensis* and *P. tenuis* of the oolitic series of England, than to any other species described by Brongniart as occurring in the coal-measures. The frond appears to have been bipinnate, with oblique alternate pinnæ; the pinnulæ are rather thin, somewhat falcate and obtuse, the margins of which vary slightly in form, being either sinuous or entire, according to their position on the frond. This fern bears considerable analogy to the *Pecopteris Lindleyana*, figured in Professor Royle's *Illustrations*.

Locality. — Jerusalem basin, Van Diemen's Land.

Pecopteris odontopteroides. (Pl. VI. fig. 2, 3, 4.)

" Frond pinnatifidly bipinnate, or flabellate ? pinnæ linear, elongate, acuminate; pinnulæ opposite, approximate, adnate, ovate obtuse, entire; veins nearly obliterated.

" There is some difficulty in assigning this species to the proper genus, in consequence of all the specimens I have examined being imbedded in a coarse sandstone, so that the venation, with the exception of a slight central depression indicative of a mid rib, is nearly obliterated. With some care, however, in detaching the matrix from the pinnulæ, I have been enabled to trace what appears to be a slight radiation in the form of the secondary veins, resembling that generally found in *Odontopteris* (whence the specific name): this may prove to be deceptive, and other specimens may perhaps better elucidate this view.

" The general contour of this fern (Pl. VI. f. 3.) somewhat resembles a single pinna of *Neuropteris conferta* Sternb.; but the pinnulæ are more oblong, and the terminal one more acuminate; but it still more closely approaches in form a pinna of *Odontopteris Permiensis*, a fern described from the Permian system, in the work on the Geology of Russia, by R. J. Murchison, Esq.

" Presuming, on the other hand, that it forms a portion of a flabellate frond, a pinna, of which a drawing only has been seen, bears considerable affinity, as to its mode of furcation, to the recent species Gleichenia flabellata, and under this point of view might be associated with the genus *Laccopteris* Presl., should the venation prove to be the same."

Locality. — Jerusalem basin.

" A figure has also been given with more lanceolate-shaped pinnulæ, which is probably only a variety of this species.

"Besides the above, the author of this volume has brought to England some drawings of other ferns from the coal-basin of Jerusalem, which it has been considered advisable not to allude to, as the original specimens have not been examined, which are in the collection of William Breton, Esq., at Launceston, Van Diemen's Land. It is desirable that the local geologists may be stimulated to make a good collection of these fossil plants, so that a careful comparison may be instituted with those of Northern Europe, as well as with the species from the Indian deposits."

ZEUGOPHYLLITES *Brongniart.* — Family uncertain.

Z. elongatus. (Pl. VI. fig. 5, 5*a*.)

"Stem — ? leaves petiolate, oblong elongate, entire, truncate, and slightly thickened at the base; veins distinct, equal, parallel.

"The specimen figured has been provisionally referred to *Zeugophyllites* Brong., as it agrees tolerably well with the characters assigned to the leaves of that genus. These leaves were probably sessile, or even amplexicaul, as might be inferred from their slightly thickened base, and pinnately arranged, at short distances, along a common stem, after the manner of the foliation of *Schizoneura* Schimper, *Convallarites* Brong., to which genus our species offers some resemblance; the leaves, however, in *Schizoneura* have fewer veins, and appear to have been somewhat carinated."

Locality. — Jerusalem Basin, Van Diemen's Land.

Phyllotheca australis Brongniart, Prod.

"Stem simple, straight, articulate, smooth, or striate; articulations surrounded by sheaths; sheaths longitudinally sulcate, foliaceous; leaves of the sheath long, linear, pointed.

"This remarkable plant, of which numerous traces remain in the shale, containing also *Glossopteris Browniana*, was first described by Ad. Brongniart. It has the general aspect of *Calamites*, but more strongly resembles *Equisetum* in the peculiar arrangement of the sheaths at the articulations; which, however, are furnished with long linear leaves, instead of being terminated by short, simple, and conical teeth, as in the ordinary sheaths of *Equisetum;* the leaves are either straight, more frequently oblique, or even reflected, and about twice the length of the sheath, which is longitudinally sulcated in the intervening spaces. The foliaceous appendages to the sheath in this plant — a character not found in any species of *Equisetum* — has induced Ad. Brongniart, notwithstanding the general analogy in external form, to consider it as entirely distinct from that genus, and more nearly related to the other genera with verticillate leaves, as *Asterophyllites*, &c., than to the true *Equisetaceæ*."

Locality.—Newcastle coal mines, New South Wales

"In reviewing the few species of the ancient flora that have been hitherto collected from the carboniferous deposits of Australia, including therein the fossil plants from the basin of the Hunter, in New South Wales, and those from the Jerusalem basin, in Van Diemen's Land, we at once perceive the interesting fact, that although limited as the species are in number, there is no trace of any of those remarkable genera so characteristic of, and so abundant in, the strata of the European and American coal-fields, such as *Lepidodendron*, *Sigillaria*, *Stigmaria*, *Calamites*, or *Coniferæ*."

"The basins themselves, if indeed contemporaneous, appear to be characterised by a distinctly localised flora ; no species, as far at least as our observations have extended, being found common to the two deposits. The basin of the Hunter contains *Phyllotheca australis*, *Glossopteris Browniana*, and some other species; in that of Jerusalem, in Van Diemen's Land, are found three or four species belonging to the genera *Sphenopteris* and *Pecopteris*, and one to *Zeugophyllites*, these being associated with some large fragments of stems, too imperfect to be defined.

"In comparing, therefore, the whole of the species at present known, from these deposits, with the coal plants of Europe, there appears, indeed, to be but few, if any, analogical forms, although the equisetoid-looking *Phyllotheca* may probably be considered as the representative of the *Calamites* of the northern deposits; while, on the other hand, its congener, the *Glossopteris Browniana*, is a fern so entirely different from any of those that are found in the carboniferous periods of the northern hemisphere.

"Among the fossil plants collected from the Jerusalem basin, we find the interesting genus *Zeugophyllites*, and certain forms of *Pecopteris*, one of which is closely allied to an oolitic species, and another having strong resemblances to an *Odontopteris* from the Permian system of Russia.

"These few observations partly lead us to infer that the flora of the southern hemisphere was perfectly distinct in its facies from the northern, at the carboniferous period; just as, at the present time, the modern flora of the same continent presents a striking difference to that of other portions of the globe ; and this appears to be the more remarkable, as the species constituting the fauna of the Australian ocean, anterior to that period, contain many forms which, if not perfectly identical, are at least the representative ones of those of the northern region.

"In instituting a comparison between the species collected from the Australian deposits, and those described from the Burdwan coal-field by Professor Royle, we observe both the remarkable analogy of form of some species and the actual identity of others; from which we may probably be led to infer that the deposition of the strata containing them was not only contemporaneous, but that the conditions of the flora of some portions of the Indian and Australian continents, at that epoch, were not very dissimilar. In the Burdwan coal-field we find the *Pecopteris Lindleyana*, *Glossopteris danæoïdes*, *G. Browniana*, and other plants, associated with two species of a very curious form, *Vertebraria indica* and *V. radiata*. The Australian deposit also contains *Glossopteris Browniana*, two or three species of *Sphenopteris*, and the same species of *Vertebraria* above noticed. The *Pecopteris australis* of the Jerusalem basin is closely allied to, if not identical with, the *P. Lindleyana* from Burdwan. The *Glossopteris danæoïdes* of the Burdwan deposit apparently belongs to the genus *Tæniopteris*, the veins being perfectly horizontal, and not anastomosed, as in the typical species of *Glossopteris*. We have previously remarked upon the absence of certain carboniferous forms in these deposits; on the other hand, if we compare some of the species with certain others, from the oolitic series of England, a striking analogy of form is at once perceptible; the *Pecopteris Murrayana*, *P. Whitbiensis*, and *Glossopteris Phillipsii* representing as it were the *Pecopteris* (*Sphenopteris*) *alata*, *P. australis*, and *Glossopteris Browniana* of the Australian strata."

PLEIOCENE FLORA.

"The two specimens of leaves, and another peculiar form, represented on Table VII. fig. 5, 6, 7, 7*a*., are from the yellowish compact limestone near Hobart Town, which has been described by Mr. Darwin, in his work on the Volcanic Islands, p. 140. These impressions have been submitted to the examination of Mr. R. Brown, who is unable to refer them to any species known to him, although one specimen has somewhat the aspect of a Proteaceous leaf. This fact is interesting, because associated in the same limestone are two species of land testacea, a *Helix* and a *Bulinus*, which Mr. G. B. Sowerby cannot at present identify with any existing analogue. These observations, taken in conjunction with the discovery by Mr. Darwin of a palmate or palm-like leaf, in the same deposit (of which no similar leafy structure has been hitherto found in Van Diemen's Land), may lead us to infer that the species imbedded in the travertin, probably represent the fauna and flora of a period slightly anterior to the present. It is to be hoped, however, that the attention of the naturalists of that colony may be directed to this subject, so that the collection of a more ample series of specimens may be submitted to still further investigation."*

RECENT FLORA.

The first persons who cast the eye of a botanical observer upon the living plants of Terra Australis, were Mr. (afterwards Sir Joseph) Banks, and his companion Dr. Solander, during the first voyage of Captain Cook (1770). Mr. Menzies, naturalist of the expedition of Captain Vancouver (1791), and Labillardière, attached to the French discovery ships under Admiral D'Entrecasteaux (1792), came next in succession: all of them secured to botanical geography valuable discoveries, and opened a vast field of inquiry.

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* J. Morris, Esq.

Important as these first discoveries were, it is a matter of no ordinary congratulation, that the task of extending them should have devolved upon Robert Brown, a botanist who, fortunately, combined with the zeal of a collector those original talents for acute and scrupulously accurate physiological investigation which the study and the arrangement of a new and unclassified vegetation especially demanded.

It was in the course of the memorable survey of Captain Flinders that this eminent naturalist had the opportunity of examining the botany of the coast of New Holland; which examination was followed by that of the flora of New South Wales and Van Diemen's Land, after the departure of Captain Flinders for Europe.

At the time when Mr. Brown commenced his labours, the number of ascertained Australian plants amounted to 1300 species, of which 1000 had been collected for the most part by Sir Joseph Banks himself.

To this original collection Brown added nearly 3000 species; a contribution to botany far exceeding any previously made by one individual, and which enabled him to begin the *Flora Australis* with upwards of 4000 species.

Of these, as he himself tells us, in the Appendix to Capt. Flinders' Voyage, upwards of 2900 species were *Dicotyledonous*, 860 *Monocotyledonous*, and 4000 *Acotyledonous ferns*, being considered as belonging to the last-mentioned division.

According, then, to these numbers, the *Dicotyledones* of Terra Australis were, at that period, to the *Monocotyledones*, rather more than 3 to 1, or somewhat less than 7 to 2.

The collections, however, made in particular regions of Terra Australis, showed that, locally, the relative proportions of the three grand divisions of plants were somewhat at variance with the general result above mentioned. In New South Wales, about Port Jackson, Mr. Brown informs us that "the proportion of *Dicotyledones* to *Monocotyledones* does not exceed three to one. At the western extremity of the same parallel, in the vicinity of King George's Sound, the proportion is but little different from that of Port Jackson, being nearly as 13 to 4. At the south end of Van Diemen's Land, it is *fully* 4 to 1, with which proportion that of the Gulf of Carpentaria, and, I may add, that of the whole of the equinoctial part of New Holland hitherto examined, very nearly agrees."*

As regards the proportion of the *Acotyledones*, Brown states that he considers his collection of some of the *Cryptogamic* order, especially the *Fungi*, very imperfect. Such, however, as it is, that collection gives the proportion of *Phenogamous* to *Cryptogamous* as 7 to 2.

To these general features of the Australian vegetation, is added a classification of the collected plants, which are arranged into 120 groups or natural orders. For the physiological observations upon some of the families, distinguished either by their constituting the mass, or by exhibiting the most striking peculiarities of the flora, the reader must be referred to R. Brown's original essay, which is found at the end of Captain Flinders' voyage.

Suffice it to say, in this place, that the admirable tract here referred to, with the "*Prodromus Floræ Novæ Hollandiæ et Insulæ*," while they have raised their illustrious author to the celebrity which he so justly possesses, serve also as a frame-work or foundation, upon which his followers in the field of botany are gradually erecting, and successfully elucidating, the Australian flora.

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* Flinders' Voyage to Terra Australis, Appendix.

The first addition to the flora thus commenced, was made by the late Allan Cunningham, of the Royal Gardens at Kew, sent out originally to New South Wales as a botanical collector, and subsequently attached to the hydrographical expedition of Capt. P. P. King. His collection comprised 1300 species of Phænogamous plants. To these may be added a second collection, which the same indefatigable and deservedly lamented botanist made, in 1830, in the course of the exploration of Moreton Bay, a region of New South Wales, at that time little known; by which the Australian flora was considerably enriched. His remarks, which are inserted in the Appendix of Captain P. P. King's Voyage, relate to some of the new plants of established natural families, which he had discovered, and to the geographical distribution of others, form a most valuable supplement to the essay of R. Brown.

The labours of Mr. Ronald Gunn next follow. His collection was obtained especially in Van Diemen's Land. As it was formed entirely by himself, and is daily enlarging, it will furnish most valuable materials towards the illustration of the botany of the island. When the writer of these pages was leaving Launceston, Mr. Gunn's collection included specimens of nearly all the vegetation of Van Diemen's Land; and, at no distant day, we may expect, from the indefatigable collector, the publication of a complete Tasmanian flora.

The contributions of the late Mr. Lawrence, Mr. Backhouse, and Dr. Joseph Dalton Hooker, referring to the eastern part of Terra Australis, and those of Leshenault de la Tour, Reidlé, Deputch, Bailly, and Mr. Drummond, derived from the western and north-western coast of that continent, which are noticed in detached papers, English and foreign, complete the list of the most prominent additions made, since the labours of R. Brown, to *Flora Australis*.

These additions, computed approximatively, will however hardly exceed 2000 new species; which, added to the 4000 which composed, in 1804, the original collection of R. Brown, make up for the actual flora of Terra Australis a total number of 6000 known species.

It would be incompatible, both with the design and the limits of this work, to insert here a catalogue of these plants: such a catalogue may, however, be found occupying the space of a large volume, in the admirable "*Prodromus Floræ Novæ Hollandiæ*," and "*Supplementum Primum Prodromi Floræ, N. H.*," of Brown; in Cunningham's Appendix to Captain P. P. King's Voyage; and the "*Botany of the Antarctic Voyage*, by I. D. Hooker, M. D., R. N.;"—to which the writer of this present notice feels he cannot better conclude than by referring the reader.

SECTION VI.

ZOOLOGY.

INTRODUCTION.

To the vegetation to which the physiognomy or general aspect of Terra Australis owes its main features, must now be added, in order to complete the delineation of that physiognomy, a notice of the Zoology of the country.

Variety, beauty, and elegance, in forms and colours, and in their combinations, characterise some of the zoological classes; while striking and wonderful peculiarities of external and internal organisation distinguish others.

All the classes may be said to offer, in their physiological structure, subjects for most interesting and instructive study.

That of the Mammalia, in particular, presents numerous instances of exceptions to the general features which characterise the Mammalia of the rest of the globe.

Thus, the largest quadruped of Terra Australis, the kangaroo, has been found to be a saltatory animal.

Thus again, the greater number of species belong to the marsupial order, as the kangaroo, opossum, kaola, &c.

And thus, too, the duck-billed Ornithorhinchus, covered with fur, moving on four webbed feet, suckling its young, and most probably viviparous, has been discovered to possess a series of contrivances by which it is fitted to live equally well in the elements proper to two distinct classes of animals. This creature, a world of wonders in itself, has been further found, by Professor Owen, to approximate to the reptiles in its generative system, and to the extinct species of *Ichthyosaurus* in its furcula and clavicle.

Examined in the haunts where they live and multiply, the various animals of this part of the world are found to possess a very limited proportion of the carnivora, as compared with the herbivora, and to be singularly divested of aggressive ferocity, venomous qualities, or weapons of attack or defence, dangerous to man. On the contrary, they are mostly inoffensive; and, although somewhat shy, are, if caught, easily tamed and familiarised. They are plentifully provided with food, and furnish, in turn, a very wholesome and appropriate sustenance to the natives. In short, all classes of the animal kingdom offer, in their respective relations to each other, and to the vegetation and climate in which they are placed, the same admirable order of adjustment and harmony which they do elsewhere on the globe.

However, like the flora of Terra Australis, so also its present zoology has been preceded by one which is extinct, and which has left us but wrecks of its existence for our study and contemplation. To geological researches we owe the discovery of its chronology; and to comparative anatomy, the knowledge of its genera and physiological character.

We shall avail ourselves of the assistance of both these sciences to inquire into the history of this remote zoology, before we attempt to give a sketch of the existing one.

FOSSIL FAUNA.

INTRODUCTION.

The Fossil Zoology of New South Wales and Van Diemen's Land, so far as our researches enable us to discover, is found to possess representatives of the three great divisions, of *Vertebrata*, *Radiata*, and *Mollusca*. The fourth, the *Articulata*, is but indistinctly indicated in small oblong impressions, resembling the *Trilobites*, not exceeding half an inch, and which are to be met with in Yass Plains and the Boree country, New South Wales, associated with *Favosites Gothlandica*, *Orthoceras*, and stems of *Encrinites*.

Throughout the geological fabric, these representatives show an extraordinary and almost solitary instance of paucity of genera, species, and individuals. The sequence, however, with which they appear in the geological formations, discovers laws similar to those which regulated the succession of genera and species in other parts of the world.

The periods of the existence and extinction of genera and species composing the Australian fossil fauna are obvious, and will form a subject of most interesting disquisition, when the two colonies shall receive the benefit of a thorough geological Ordnance survey.

For the present, it will be expedient to consider the organic remains of the two colonies, but in reference to two distinct epochs: the first as anterior to the deposition of Jerusalem coal, and corresponding to the Palæozoic series; the last as posterior to it, and belonging to the Pleiocene epoch.

PALÆOZOIC FAUNA.

POLYPARIA.

I am greatly indebted to Mr. Lonsdale, F.G.S., for the following important and interesting description and remarks upon the specimens of the Australian fossil *Polyparia* which I have collected in New South Wales and Van Diemen's Land, and which Mr. Morris had submitted to his examination.

STENOPORA.

A ramose spherical or amorphous tubular polypidom: tubes polygonal or cylindrical, radiated from a centre or an imaginary axis, contracted at irregular distances, but in planes parallel to the surface of the specimen; tubular mouths, closed at final (?) period of growth; ridges bounding the mouths, granulated or tuberculated; additional tubes, interpolated.

The examination of Strzelecki's collection of fossil *Polyparia*, from Van Diemen's Land, has extended the knowledge of the corals, for which the name of *Stenopora* was proposed in the Appendix to Mr. Darwin's work on Volcanic Islands, and induced the describer to give the preceding notice of the generic characters.

Stenopora Tasmaniensis. (Pl. VIII. fig. 2—2*e*.)

" Branched, branches cylindrical, variously inclined or contorted; tubes more or less divergent; mouths oval, divisional ridges strongly tuberculated; indications of successive narrowing in each tube, 1—2." (See Mr. Darwin's work on Volcanic Islands, p. 161.)

Several casts of a ramose *Stenopora*, believed to belong to this species, were noticed in the collection examined, but they did not admit of a complete identification.

Locality.—Mount Wellington, Mount Dromedary, Norfolk Plains, Van Diemen's Land.

Stenopora ovata. (Pl. VIII. fig. 3—3*b*.)

"Branched, branches oval; tubes relatively short, divergence great; mouths round; contractions or irregularities of growth numerous." (Op. cit. p. 163.)

The structure of this species was not fully exhibited in the specimens originally examined; but in Strzelecki's series was a fine ramose coral, believed to be identifiable with *Sten. ovata*, as it possessed characters in accordance with those previously noticed: it supplied also others, which confirmed the inference, that this fossil is specifically distinct from *Sten. Tasmaniensis*.

The beautiful specimen alluded to, consisted of a main cylindrical branch, 3½ inches in height, 7 lines in diameter at the lower extremity, and 4 near the upper, where the curvature of the termination commenced. From this branch several others, varying in width from 2 to 7 lines, diverged either obliquely or at right angles: the tubes sprung successively from an imaginary axis, but with numerous interpolated additions, and radiated more or less rapidly, sometimes at very obtuse angles. In the centre of the branches, and before the deflection became marked, they were in contact and polygonal; and the contractions, though relatively distant, were very decided, giving that portion of the coral a peculiar aspect, and indicating apparently periodical renewals of growth. In no case, however, was there a satisfactory proof of the mouth of the tubes having been perfectly closed, as noticed on the exterior of a branch of *Sten. Tasmaniensis*, believed to mark a condition of the ultimate stage of developement. From the points where the rapid divergence commenced, the tubes were more or less separated and cylindrical; and the contractions became very numerous, though each series was singly not so conspicuous as in the centre of the branches. The casts of the mouths, so far as they could be ascertained, were round, and instead of being encircled, as in the preceding species, with a row of granules or indentations, there was only a single impression of a relatively large tubercle at the cast of the interspace between four mouths, where the rows occurred regularly or between a less number where such was not the case.

Locality.—Mount Wellington, Mount Dromedary, Norfolk Plains, Van Diemen's Land.

Stenopora informis. (Sp. nov. Pl. VIII. fig. 4, 4*a*.)

Amorphous; tubes cylindrical, slender, unequally divergent; contractions variable.

This coral was considered to be distinct from the two preceding species on account of its mode of growth, and its affording no grounds for inferring that the specimens had formed the base of a ramose polypidom.

The section of this *Stenopora* which was examined was imbedded in a fragmentary rock cemented by a felspathic paste, and the whole of the calcareous or original substance of the coral had been removed. The exposed surface was irregular in outline, but the greatest width was two inches, and the greatest height one and a quarter. The diameter of the internal casts of the tubes was about a quarter of a line. Near the base of the specimen the tubes were vertical for a limited portion of the upward range; but even there, they exhibited no signs of lateral compression. The degree of divergence was very unequal, amounting in some places almost to the curvature of a quadrant, and gave the section the appearance of being composed in part of dislocated fragments. The distance between the contractions also varied considerably, being often very small, but the lines of indentations had a great persistence: their parallelism, however, was limited on account of the irregularities in the mode of growth. The imbedded position of the coral completely prevented the characters of the tubular mouths and of the interstices from being ascertained. The original walls of the tubes were, as in the other species, apparently very thin, except at the points of contraction. Numerous examples of interpolated tubes were noticed.

Locality.—Spring Hill, Van Diemen's Land.

Stenopora crinita. (Sp. nov. Pl. VIII. fig. 5, 5*a*)

Hemispherical or globular; tubes polygonal, slender; contractions distant.

This fossil has a great general resemblance to the *Chætetes* of M. Fischer de Waldheim, particularly to *Chæt. radians*, (Oryct. *Gouvern. de Moscou*); but it is distinguished by the contractions characteristic of *Stenopora*, and by the additional tubes having been essentially produced by interpolations.

The specimen examined consisted wholly of calcareous spar, and formed part apparently of a globular or hemispherical mass, which must have possessed considerable dimensions, the radius of the fragment being 4½ inches. The tubes were about one-third of a line in diameter, and radiated in general very slightly; but they were irregularly bent in some portions of their range. They were polygonal throughout, both externally and internally, except at the contractions; and the infiltered calcareous matter had not only filled the interior of the tube, but had also replaced for the greater part the substance of the original walls. The contractions, as exposed in a vertical section, presented series of parallel, transverse, slight indentations, from one to two lines apart, indicating a perfectly simultaneous process in the polypes; and even young or interpolated tubes, which commenced almost immediately below a row of indentations, exhibited as marked a contraction as the adjacent fully developed columns. In the superior terminal surface, as well as in transverse fractures in the plane of the contractions, the tubes were lined by a narrow band, slightly varying in breadth, but never approaching to the nature of a diaphragm.

Perfect terminal mouths were not observed: and in the instances on the upper surface of the specimen, which exhibited the most advanced state, the mouths were defined by white lines more or less circular, and separated by small intervals of a darker colour. The additional tubes were irregularly interpolated, and sometimes sprung from the lines of contraction, but sometimes commenced in the spaces between them. In the former cases the inferior terminations were generally more or less obtuse, while in the latter they were usually very sharp. The form of the adjacent mature tubes was more or less influenced by the interpolations, owing apparently to the expanding pressure of the growing young polype.

Locality.—Illawara, New South Wales.

Favosites Gothlandica? (Lamarck.)

Of the fossil assigned with a doubt to this species of *Favosites*, several specimens were included in Strzelecki's collection, but the mode of preservation did not permit their characters to be fully ascertained. In one instance only was a succession of connecting foramina detected. It constituted a single row of round or oval openings, much larger than in the ordinary *Favosites Gothlandica* of Europe, but very similar to the foramina of an American coral in Mr.

Lyell's cabinet, and believed to be only a trans-Atlantic form of Lamarck's species. Whether the Australian fossil varied in the arrangement of these connecting openings, and agreed with the American and European in having sometimes one, sometimes two, rows of foramina on the same facet of a column, or whether it possessed uniformly a single row, and consequently a specific difference, could not be determined. It was, therefore, deemed advisable to assign the specimens provisionally to the nearest known species.

Locality.—Yass Plains, New South Wales.

Amplexus arundinaceus. (Sp. nov. Pl. VIII. fig. 1.)

Oval; exterior longitudinally ribbed, transversely annulated; septa slightly convex or flat, margins faintly crenulated.

This *Amplexus* differed from the published species known to the describer, by the rounded longitudinal ribs and transverse annular irregularities. In external aspect it resembled some coal-measure calamites.

The length of the finest fragment examined was about two inches, and the major and minor axes were respectively 7 and 6 lines; but in the same mass of black limestone were other portions, of slightly smaller dimensions. The crenulations near the margins of the septa or diaphragms were unequal in range as well as strength, and in some cases they were scarcely detectable. In one instance, under a favourable oblique light, converging radii were traced from nearly half the periphery of the oval, across more than two-thirds of the area; but the opposite extremity of the diaphragm was uneven, and not traversed by radii or crenulated. The most marked convex irregularity was exhibited in the superior septum, and resembled that delineated by M. de Koninck in one of his figures of *Amp. coralloides* (*Amp. Sowerbii*, Phillips), and there was a further agreement in the Australian fossil having also a few relatively bold furrows, or crenulations, between the centre of the convexity and the margin of the diaphragm. (Desc. *Anim. Foss. Terr. Houill. &c., de la Belgique.* Pl. B. fig. 6. *c.*)

Locality.—Shoalhaven, Barbers, New South Wales.

It is not possible to allude to the occurrence of a *Favosites* and an *Amplexus*, in Strzelecki's collection without soliciting attention to the additional evidence they afford in support of previous inferences respecting the age of the deposits in which fossil polyparia were found by Mr. C. Darwin; or to the curious increase of agreement thus presented between the *Palæozoic Fauna* of Europe and extinct *Faunæ* of New South Wales and Van Diemen's Land.

Fenestella ampla. (Pl. IX. fig. 3—3*d.*)

"Cup-shaped; celluliferous surface internal; branches dichotomous, broad, flat, thin; meshes oval; rows of cells numerous, rarely limited to two, alternate; transverse connecting processes sometimes cellular; inner layer of non-cellular surface very fibrous; external layer very granular, non-fibrous; gemmuliferous vesicle? small." (Appendix to Mr. Darwin's work, p. 163.)

Among the specimens of this coral contained in the collection under consideration, was one which afforded some interesting changes dependent upon age, the absence of which in the series originally examined was alluded to in the notes upon the species. (Loc. cit. p. 165.) In the uppermost portion of this specimen, the casts of the cellular surface exhibited similar characters to those displayed in Mr. Darwin's series, with the addition, occasionally, of a crescent-shaped impression under the mouth, and due, it is believed, to a local modification of the sculpturing on the surface of the other cells. A little lower the ridges, or furrows representing them, began to disappear, and still lower, by a further thickening of the exterior, all traces of them were obliterated, the interspaces between the mouths displaying irregular protuberances; and that which was considered as a state bordering upon decrepitude exhibited casts of minute oral apertures, with larger projections immediately beneath, marking the original extension of the mouths.

Locality.—Spring Hill, Mount Wellington, Eastern Marshes, Van Diemen's Land.

Fenestella internata. (Pl. IX. fig. 2—2*b*.)

"Cup-shaped; celluliferous surface internal; branches dichotomous, compressed, breadth variable; meshes oblong, narrow; rows of cells 2—5, divided by longitudinal ridges; transverse connecting processes shut, without cells; non-cellular surface, inner layer sharply fibrous, outer layer minutely granular." (Appendix to Mr. Darwin's work, p. 165.)

Locality.—Mount Wellington, Van Diemen's Land; St. Patrick's Plains, Raymond Terrace, New South Wales.

Fenestella fossula. (Pl. IX. fig. 1, 1*a*.)

"Cup-shaped; celluliferous surface internal; branches dichotomous, slender; meshes oval; rows of cells two; transverse processes non-cellular; inner layer of non-celluliferous surface minutely fibrous, external layer smooth or granular." (Op. cit. p. 166.)

Locality.—Mount Wellington, Van Diemen's Land; St. Patrick's Plains, Raymond Terrace, New South Wales.

Hemitrypa sexangula. (Pl. IX. fig. 4, 4*a*.)

"Network fine, hexagonal; meshes round, in double rows." (Op. cit. p. 167.)

Locality.—Mount Wellington, Van Diemen's Land.

MOLLUSCA.

Mr. J. Morris, who furnished the preceding section, of Botany, with a valuable paper upon the Fossil Flora of New South Wales and Van Diemen's Land, has kindly favoured me with the following account of the fossil *Mollusca* found in my collection.

CONCHIFERA.

Allorisma curvatum. (Pl. X. fig. 1.)

Shell transverse, inequilateral, closed anteriorly, slightly gaping posteriorly, gibbose, front compressed, posterior side produced and incurved; beaks inflated, rounded, and approximate; surface concentrically marked with distinct but rather irregular sulcations, crossed by very faint radiating obtuse ridges; ligament large, external; posterior muscular impression distinct, anterior obscure; breadth 4½ inches; length 3 inches.

This shell bears considerable resemblance to the *Pholadomya Munsteri* (D'Archiac and De Verneuil), but the anterior side is more obtuse, and the posterior less produced, than in that species, and slightly gaping; the folds on the surface are also much more irregular. It has the general form of *Pholadomya*, and might be included under the genus *Homomya Ag.*, established for those species of *Pholadomya* in which the radiating costæ are wanting, or not very prominent, if their absence alone could be considered sufficient for a generic division. I have provisionally placed this shell in the genus *Allorisma* (King), instituted for the reception of certain species of *Sanguinolaria*, as *S. sulcata*, *S. elongata*, &c., which have, according to that author, peculiar dental characters, and a more or less deep siphonal scar in the palleal impression.*

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* Mr. Tate, of Alnwick, has kindly furnished me with a specimen of *S. sulcata*, showing clearly that the palleal impression was perfectly entire.

Sanguinolites (M'Coy) appears to be somewhat synonymous with *Allorisma;* but under that genus have been included some forms (*S. contorta*, &c.) having an entire palleal impression.

Locality.—Illawara, New South Wales.

PACHYDOMUS (παχύς *crassus*, δόμος *domus*).
Megadesmus (J. Sowerby).

Shell equivalved, inequilateral, very thick; hinge line sunk, with an antiquated area, and one or two (?) large teeth in each valve; ligament large, external; impressions of the adductor muscles very prominent, the posterior one larger than the anterior; retractor muscle distinct; palleal impression entire, broad, sometimes furnished with a very shallow sinus posteriorly; lunette more or less defined.

The above description is nearly similar to that given by Mr. J. Sowerby, in Sir T. Mitchell's work on Australia, for three or four species of very thick and rugose shells resembling *Astarte* in the character of the muscular impressions. The teeth have hitherto only been observed in imperfect casts of some of the species, from which it would appear that the one in the left valve is the largest, and thickened posteriorly; the muscular impressions are very deep, and the retractor muscle of the foot placed above the anterior adductor, is very distinct.

I have proposed the term *Pachydomus*, expressive of the thick shelly covering of the species constituting this genus, instead of *Megadesmus*, given by Mr. J. Sowerby, that generic title having been previously adopted by Bowdich for a genus of fluviatile *Conchifera*, named *Galathea* by Lamarck; *Potamophila*, G. B. Sowerby. The following species belong to this genus:—

P. antiquatus. Megadesmus antiquatus. (J. Sowerby, in Mitchell's Australia, Pl. I. fig. 2.)

Shell transversely elliptical, inequilateral, somewhat compressed; ligamental area oblique; lunette linear, deep.

Locality.—Wollongong, New South Wales.

P. cuneatus. Megadesmus cuneatus. (J. Sowerby. Ibid. Pl. I. fig. 3.)

Shell somewhat trapeziform, very inequilateral, anterior side truncate, posterior rather rounded, front compressed. Mr. Sowerby observes, that this species differs from *P. antiquatus* only in having the shell a little contracted towards the anterior side.

Locality.—Wollongong.

P. lævis. Megadesmus lævis. (J. Sowerby. Ibid. Pl. I. fig. 1.)

Shell transversely oval, gibbose; umbones nearly central, anterior side rounded, posterior slope slightly depressed.

Locality.—Illawara, New South Wales.

P. globosus. (Pl. X. fig. 2, 3.)
Megadesmus globosus. (J. Sow. Ibid. Pl. III.)

Transversely obovate, ventricose, concentrically sulcated, anterior side small, slightly produced, posterior slope depressed; beaks approximate, incurved; breadth, 7 inches; length, 4½ inches.

I had at first considered this shell as more nearly related to *Allorisma* than to *Pachydomus*, from some slight appearances of a sinus in the palleal impression: these markings, however, are very undefined; and this shell, having the general characters of the other species belonging to the latter genus, has also been referred to the same.

Locality. — Illawara (New South Wales). Spring Hill (Van Diemen's Land).

P. carinatus. (Pl. XI. fig. 3, 4.)

Transversely ovate, elongated, very convex, rugose, posterior side more or less carinated, truncated at the margin, front slightly compressed, beaks prominent, about one third from the anterior margin; muscular impressions distinct, large, united by the entire palleal impression.

This species has considerable resemblance to the *Cypricardia cordiformis*, Deshayes, both as regards the general contour of the shell and the distinct muscular markings.

Locality. — Illawara (New South Wales).

Orthonota? costata. (Pl. XI. fig. 1, 2.)

Shell elongate, inequilateral, cylindrical, rather compressed, posterior part traversed obliquely by twelve or fifteen prominent costæ, anterior portion small, rugose; beaks small, near the anterior extremity; muscular impressions very distinct, united by a simple well-marked palleal impression.

This is a very distinct species, and bears some general resemblance to *Cypricardites corrugata*, Conrad. *Jour. Ac. Nat. Sc. Philadelphia*, 8. t. 13. f. 1. The anterior portion is rugosely sulcated, the posterior obliquely traversed, beyond the umbonial slope, by twelve to fifteen costæ; the muscular impressions are strongly defined, the anterior adductor being separated from the palleal impression by a slight thickening of the interior shell, producing a furrow in the cast, as shown in the figure; the lunette is small, somewhat lanceolate, with steep sides.

Locality. — Illawara.

Orthonota? compressa. (Pl. XIII. fig. 4.)

Transversely elongate, very inequilateral, dorsal and basal margins nearly parallel; beaks very near to the anterior part, which is somewhat truncate, posterior end rounded; muscular impressions distinct, palleal impression entire.

This shell has somewhat the general form of *Cardinia concinna*, Ag., but wants the thick hinge of that species; the dental characters are very obscure.

Locality. — Spring Hill (Van Diemen's Land).

I have provisionally placed the two last-described shells in Conrad's genus *Orthonota*, from the general resemblance they present in external form to the species included under that generic title, rather than from any peculiarity in the dental character or situation of the muscular impressions, neither of which are mentioned by Mr. Conrad in his description of that genus. Unfortunately the dental and muscular characters of many of the Palæozoic bivalve testacea, (especially those species elongated in the direction of the hinge-line, with the dorsal and basal margins nearly parallel,) either have not been observed, or are but imperfectly known; without these characters it is certainly very difficult to arrange them systematically, and therefore, perhaps, the establishment of provisional genera may be of some service to palæontology, if only to place before us the numerous forms of the Palæozoic series; and therefore many of them are but arbitrarily located under genera to which they present only some analogy in external form. In the carboniferous limestone of England and Ireland, many forms are associated together, which may ultimately be found to belong to very distinct genera. From the heterogeneous assemblage of species hitherto placed under *Sanguinolaria*, to which they certainly bear little affinity, Mr. King has, by a careful examination of the ligamental and muscular characters, abstracted a few species, with the generic title of *Allorisma*. Mr. M'Coy has included a larger number under his genus *Sanguinolites* (partly synonymous with *Allorisma*); and other somewhat similar forms, chiefly from the silurian strata of America, have been arranged by Mr. Conrad under the genera *Orthonota* and *Cypricardites*. The two species here provisionally placed under *Orthonota*, I am inclined to believe are very closely related to *Sanguinolaria transversa*, and *S. undata* Portlock, which latter forms, very probably, have an entire palleal impression, and may therefore be distinct from the true *Allorismæ*, and considered worthy of a generic subdivision.

EURYDESMA (*εὐρύς latus*, *δεσμός ligamentum*).

"Testa æquivalvis, suborbicularis, tenuis, ad umbones crassissima, areâ ligamenti elongatâ, latâ, ferè omnino internâ, dente valvæ dextræ magno, obtuso, sinistræ inconspicuâ, canali byssifero antico ex umbonem ad marginem testæ decurrente; impressionibus muscularibus plurimis, parvis ex internam partem umbonis anticè decurrentibus."

At first inspection I was disposed to regard this shell as a relation of *Isocardia;* a more careful examination of all the specimens I have seen has, however, compelled me to entertain different views. I have ascertained that it really belongs to the *Monomyaria*, and that it ought to be arranged very near to *Avicula*, from which I believe it is only to be distinguished by its ventricose form and the position of its great muscular impression, which, instead of being nearly central, as in *Avicula*, (including *Meleagrina*, Lam.) is placed anteriorly.

I have to acknowledge the kind assistance of Mr. G. B. Sowerby, to whom I submitted the specimens figured (Pl. XII.), for pointing out the peculiar characters, and interesting affinities of this genus, as well as for the above detailed generic description. Only one species of this genus is at present known, to which it is proposed to give the name of *Eurydesma cordata.*

E. cordata. (Pl. XII.)

Isocardia? (Mitchell's *Australia*, Pl. II. f. 1, 2.)

Shell somewhat orbicular or cordiform, gibbose, nearly equilateral, surface radiately striate; beaks incurved, approximate.

This is a very ventricose and cordiform shell, the external surface being indistinctly radiately striated, a character which is well represented in the figure of this species given in Plate II. of Sir T. Mitchell's *Expeditions into Australia.* The ligamental area, dental characters, and small muscular impressions are carefully illustrated in Pl. XII. of the present volume.

Locality. — Illawara (New South Wales).

Pterinea macroptera. (Pl. XIII. fig. 2, 3.)

Obliquely spathulate, nearly convex, bilobed, smooth; anterior lobe small, posterior ear distinct, large, rectangular, hinge-line rather shorter than the shell.

This shell bears some general resemblance to those species placed in the genus *Pteronites* M'Coy. It has, however, a peculiar character: anterior to the beaks, in each valve, is a deep linear oblique pit or fissure, the cast of a calcareous plate, or more probably of a tooth, which is not alluded to as being found in *Pteronites*, and does not exist in *Avicula*. By this character it is more nearly related to *Pterinea*, although the lengthened lateral teeth are not strongly defined.

Locality. — Spring Hill (Van Diemen's Land).

Pecten Illawarensis. (Pl. XIV. fig. 3.)

Orbicular, depressed, smooth, with sixteen prominent rounded rays, slightly flattened in the centre; ears small.

This is a large and well-defined species, with very prominent rays, which are not quite so broad as the intervening furrows. It is very distinct from the generality of Palæozoic forms usually belonging to this genus.

Locality. — Illawara (New South Wales).

Pecten limæformis. (Pl. XIII. fig. 1.)

Shell suborbicular, oblique, inequilateral, most convex towards the beak; rays numerous, irregular, approximate near the beak; ears rather small, wrinkled.

This is a very large and oblique species of *Pecten*, with about thirty-six obtusely angular ridges.

Locality.—Eastern Marshes (Van Diemen's Land).

Pecten Fittoni. (Pl. XIV. fig. 2.)

Orbicular, wider than long, with about fifteen rounded rays, each bearing from three to five slightly elevated granular striæ; furrows equal in breadth to the ribs, and divided in the centre by a small ridge; ears equal.

Locality.—Mount Wellington (Van Diemen's Land).

I have dedicated this species to Dr. Fitton, who, independently of the numerous contributions to the geology of England, has always taken an active interest in the geology of the Australian continent.

Pecten squamuliferus. (Pl. XIV. fig. 1.)

Orbicular, depressed; ribs numerous, nearly equal, close, imbricated with small scales; ears large, unequal, triangular, similarly marked to the rest of the shell.

Locality.—Mount Wellington (Van Diemen's Land.)

BRACHIOPODA.

Terebratula cymbæformis. (Pl. XVII. fig. 4, 5.)

Form oval, ventral valve very gibbose, the mesial portion slightly flattened, and nearly straight from the beak to the front, which is truncate; beak of the dorsal valve large and prominent: the whole of this valve is very much incurved: length 2 inches, breadth 1¼ inch.

Locality.—Raymond Terrace (New South Wales).

This is rather a remarkable form of *Terebratula:* the dorsal valve is regularly curved, so that the front margin and the beaks are level with each other. The surface of the shell is marked with concentric acute ridges.

Terebratula hastata. (Sow. *Min. Con.* t. 446.)

Two specimens from Illawara exactly agree with some varieties of this species from Bolland, Yorkshire: they are of an ovate pentagonal form, with a depressed and slightly rounded front; the sides of the beak angulated; length 1 inch. The whole surface of this shell is marked with the characteristic punctations of the smooth *Terebratulæ*, and which may also be detected in the corresponding species from Bolland, when carefully observed.

Locality. — Illawara and Raymond Terrace (New South Wales).

Spirifer (*Terebratula?*) *crebristria.* (Pl. XV. fig. 2.)

Shell transversely elliptical, depressed; mesial fold rather large, rounded and undefined; surface marked with numerous, fine, radiating, closely approximated striæ, crossed by the faintly prominent lines of growth; width exceeding the length by one fourth.

This species belongs to the Terebratuliform division of *Spirifer* of Professor Phillips, and would be more properly arranged under *Terebratula*, if the subdivision (*Athyris*) proposed by M'Coy be not generally adopted, as it agrees with certain species having many essential characters in common, viz., the radiately and concentrically striated surface, the absence of the area, the perforation of the dorsal valve, without a deltidium, &c., as may be observed in *T. concentrica*, *T. undata*, *T. pectinifera*, *T. Roysii*, &c., to which latter form our species is very closely related. It appears to be the representative form of *Sp. glabristria* (Phillips). The shell is elliptical and depressed, the lines of growth forming slightly prominent ridges.

Locality. — Booral (New South Wales).

Spirifer Darwinii.

Shell transversely oval, valves equally convex, with three broad rounded ribs on each side, mesial lobe divided; beaks small; hinge-line short. Casts of this species have only been observed. It is a very neat shell, and presents some resemblance to the young state of one of the varieties of *S. subradiatus* (Pl. XV. fig. 5*a*); the ribs, however, are much more prominent, and I have not seen any of very large size, and which occur as casts only in a sandstone from Glendon.

Locality. — Glendon (New South Wales).

I have dedicated this species to Mr. C. Darwin, who has very largely contributed to the advancement of physical geology and natural history generally.

Spirifer Tasmaniensis. (Pl. XV. fig. 3, 4.)

Syn. *Sp. rotundata*, G. Sow. in Darwin, *l. c.* p. 159.

Shell transversely oval, front depressed; dorsal valve with about ten rather angular (sometimes furcate) ribs on each of the mesial furrow, which is broad, extending to the beak, and contains three or four ribs similar to the lateral ones; cardinal area broad, hinge-line as wide as the shell.

This is the same species as that described by Mr. G. Sowerby under the name of *Sp. rotundata*, in Mr. Darwin's work, before alluded to; that gentleman having kindly allowed me to inspect the original specimen. It is very distinct from the *Sp. rotundata*, Sow. *Min. Con.* In that species the mesial ridge and furrow are very nearly smooth; the lateral ribs are broad, flattened, and oblique, and the cardinal area very narrow; in our species the mesial ridge and furrow are equally costated with the rest of the shell; the lateral ribs are angular, sometimes imbricated; the cardinal area broad, and as wide as the shell. As justly observed by Mr. Sowerby, this is rather a variable species, the lateral ribs being more numerous on one than on the other side of the same valve. I am inclined to regard his *Sp. trapezoidalis* var. as provisionally belonging to this species, from a comparison of the specimens, although the latter form is very closely related to *S. Stokesii*.

Locality.—Eastern Marshes (Van Diemen's Land).

S. subradiatus. — (Pl. XV. fig. 5, 5 *a*. Pl. XVI. fig. 1, 4.)

Syn. *Spirifera subradiata*, G. Sowerby, in Darwin, *l. c.* p. 159.

Shell transversely elliptical, smooth, nearly as long as wide, lateral surfaces, with a few undefined ribs, and numerous faintly elevated ridges, more visible in the cast; mesial ridge broad, bilobate, defined by a furrow on each side; corresponding mesial sulcation very large and wide. Beak of the dorsal valve prominent, hinge-line about half the width of the shell.

I have referred the specimens figured Pl. XV. fig. 5, 5*a*. to this species, first described by Mr. G. Sowerby in Mr. Darwin's *Geological Observations on the Volcanic Islands*, p. 159., presuming them to be the same, not having been enabled to examine the original specimens. There are two varieties of this species, one, as above described, with very faint lateral costa and a divided medial lobe; the other, in which these ribs are more prominent, the medial lobe undivided, the beaks more close, and the surface of the shell marked by numerous, minute, elongated punctations, more or less regularly arranged in a quincuncial manner; on the internal casts of this species, numerous longitudinal furrows may be detected on the lateral surfaces. Casts of this species are abundant at Mount Wellington, sometimes measuring four inches in width, and exhibiting a cast of the deep large muscular impressions in the dorsal valve; in the ventral valve, the dental lamellæ are obliquely placed on each side of the mesial lobe, and slightly arched in a portion of their length. In the specimen figured Pl. XVI. fig. 2. the spiral shelly supports are beautifully preserved; one of them is distorted from the original position.

Locality.—Illawara, Glendon (New South Wales), Mount Dromedary and Mount Wellington (Van Diemen's Land).

Spirifer avicula. (Pl. XVII. fig. 6.)

Syn. *S. avicula*, G. Sow. in Darwin, *l. c.* p. 160.

Transversely fusiform, nearly three times as wide as long; lateral ribs large, oblique, six to nine on each side, each one composed of three or four smaller ribs (scarcely visible in the cast); mesial lobe prominent, ribbed; hinge-line straight, as wide as the shell, with pointed ends; width, 4½ inches; length, 1½ inches.

Three or four ribs in this species are grouped together, forming about six to nine prominent ones on the lateral surfaces: the dorsal muscular impression is tongue-shaped, with a divided furrow, and depressed. Mr. Sowerby mentions that the posterior inner surface of both valves of *Sp. vespertilio* is covered with distinct punctulations, but in this species it is the dorsal valve only that has been punctulated.

Locality.—Eagle Hawk Neck (Van Diemen's Land).

Spirifer vespertilio. (Pl. XVII. fig. 1, 2, 3.)

Syn. *Spirifer vespertilio*, G. Sow. in Darwin, *l. c.* p. 160.

Transversely fusiform, with distinct, angular, imbricated ribs, 15 to 20 on each side; ventral valve with a prominent mesial ridge, extending to the beak, bearing 2 to 5 ribs similar to the lateral ones, and a corresponding deep, broad furrow on the dorsal valve; breadth more than double its length; hinge-line straight, as wide as the shell; breadth 4 inches; length 1½ inches.

This species belongs to the fusiform group of *Spirifera*, such as *Sp. convoluta* Phillips: it closely resembles in the straightness of the hinge-line and general form the *Delthyris mucronata*, Conrad, *An. Rep.* 1841, which has 20 serrated ribs on each side, and also the *Sp. Lyellii* of Verneuil; in the latter species the dorsal valve is much more gibbose than the ventral, and the smooth sinus is divided by a slight rib; in our species both valves are nearly equally convex, and the dorsal sinus has three distinct ribs. In the cast the lateral ribs are only observable near the margin, and the central muscular impression in the dorsal valve is very prominent and nearly orbicular.

Locality.—Eagle Hawk Neck (Van Diemen's Land).

Spirifer Stokesii. (Pl. XV. fig. 1. 1 *a.*)

Syn. *Trigonotreta Stokesii.* (König, *Icon. Foss.* f. 70.)

Sp. trapezoidalis, G. Sow. in Darwin, *l. c.* p. 159.

Shell globose, transversely obovate; mesial furrow broad, distinct, extending to the beak, with three slightly elevated ridges; lateral ribs four or five on each side, large, and rather rounded; beaks prominent, much incurved; hinge line as wide as the shell.

This is a very rough-looking species, in consequence of the paucity and size of the lateral ribs, which are sometimes subdivided into three, the central one being still prominent.

Locality. — Mount Dromedary (Van Diemen's Land). In limestone.

This species is very distinct from the *Spirifer* *trapezoidalis* (*Cyrtia* Dalman), so that the specific name given to this species by Mr. König must consequently be adopted.

Productus brachythærus. (Pl. XIV. fig. 4, *a*, *b*, *c*.)

Syn. *Productus brachythærus*, G. Sow. in Darwin, *Volc. Isl.* p. 158.

Trapeziform, very convex, with rather square sides, nearly smooth, spinose; base of the spines much elongated or decurrent; hinge-line straight, nearly the width of the shell; front slightly depressed.

This is rather a curious species of *Productus;* the surface of the shell has a silky aspect, and the base of the spines form long channels within the substance of the shell; the hinge-line is rather short, a character which, however, varies according to the age of the individual.

Locality.—Illawara, Raymond Terrace (New South Wales); Eastern Marshes, Mount Wellington, &c. (Van Diemen's Land).

Productus subquadratus.

Somewhat quadrate, gibbose, surface marked with irregular, coarse, longitudinal ribs, bearing bluntish spines; sides flattened; front produced; mesial furrow broad and distinct; hinge-line as wide as the shell; width 3 inches, height 2½ inches.

This shell somewhat resembles *P. antiquatus*, but the mesial furrow is very defined; and there are no traces of the concentric undulations which cover the rostral portion of that species.

Locality. — Mount Dromedary and Mount Wellington (Van Diemen's Land).

There are one or two other species of *Productus* in too imperfect a state to be defined specifically.

GASTEROPODA.

Littorina filosa. (Pl. XVIII. fig. 4.) J. Sow. in Mitchell's *Australia*, Pl. II. fig. 5.

Shell turreted, acute, formed of six convex volutions, transversely marked by six rather acute and slender ribs, forming sulci between them; mouth ovate.

This shell is figured in Sir T. Mitchell's *Australia*, p. 15., under the above name, which I have thought advisable to retain, as it would be difficult to decide the genus to which it otherwise belongs, from the imperfect state of preservation of the mouth in all the specimens hitherto examined.

This species so closely agrees in general form and size with the *Loxonema sulcatula*, M'Coy, that I should find considerable difficulty in distinguishing them. Mr. M'Coy mentions that his species is girt with about ten equal spiral sulcations; in the New Holland specimens these vary from six to eight. I should hesitate in placing either species under *Loxonema*, as the aperture appears to differ from the shells usually assigned to that genus, and the whorls are furnished with spiral ridges instead of the oblique arched striæ of *Loxonema*.

Locality. — Booral (New South Wales).

Turritella tricincta. (Pl. XVIII. fig. 3.)

Shell elongate, composed of seven slightly flattened volutions, each spirally striated with three granular lines, the central one rather more prominent than the others; suture distinct; length half an inch.

This is an exceedingly small species, and resembles generally the characters given of *T. acicula* Phillips.

Locality. — Booral (New South Wales).

PLATYSCHISMA. (*M'Coy.*)

P. oculus. (Pl. XVIII. fig. 1.)

Syn. *Trochus oculus*, J. Sow. in Mitchell's *Australia*, Pl. II. fig. 3, 4.

Shell suborbicular; spire short, conical, and obtuse, with four gradually increasing volutions, the last one having an obtusely carinated edge; aperture subtrigonal; umbilicus deep; base somewhat convex.

This species so closely agrees in nearly all its characters with the *P. cirroides* M'Coy, that I feel some hesitation in considering them as distinct; the figures and description of that author answer tolerably well for our species, which is however rather more depressed; and the well-preserved conditions of the specimens exhibit the pearly lustre of the original shell, which appears to have been rather thick, and furnished with a distinct and deep umbilicus.

Locality. — Harper's Hill (New South Wales). Abundant.

P. rotundatum. (Pl. XVIII. fig. 2.)

Shell nearly orbicular, obtusely conical; volutions four, gradually increasing, and distinctly rounded; base convex; aperture suborbicular.

This species agrees in nearly all the important characters with the last, of which it might be considered merely a variety; the volutions are more distinctly rounded, and the inner part of the outer lip appears to have been periodically thickened, leaving deep sulcations in the cast of this shell; the shallow sinus in the outer lip is not well defined in this species; and from the thick and pearly shell, the distinct umbilicus and undefined suture, it might have been associated with *Trochiscus* G. Sow. In that genus, however, the shallow sinus appears to be wanting.

Locality. — Harper's Hill (New South Wales). Abundant.

Pleurotomaria Strzeleckiana. (Pl. XVIII. fig. 5.)

Shell subturreted, umbilicate, formed of five rather rounded volutions, separated by a distinct suture; an obtuse keel, defined in the cast by two slight sulcations, divides the volutions into two nearly equal parts, of which the superior is rather the smaller; base and columella rounded; aperture longitudinal. The lines of growth turn rather abruptly backwards from the suture to the keel, and afterwards gradually curve towards the umbilicus. Right lip somewhat angular, and furnished with a deep fissure corresponding to the external keel.

This shell presents the general contour of *Pleur. vittata* Phillips, *Geol. York*. t. 15. f. 24.; but is well distinguished by having an obtuse keel instead of the broad and flat band of that species; it also resembles in size and form the *P. tornatilis* Phil., as figured by De Koninck, in his work on the carboniferous fossils of Belgium. This appears to be an abundant species, and occurs both at Illawara and Glendon, New South Wales.

I have dedicated this species to the author of the present work, to whose indefatigable industry we are indebted for a more intimate knowledge of the physical structure of the Australian continent.

Pleurotomaria subcancellata. (Pl. XVIII. fig. 6.)

Shell large, conical, formed of six rather quadrate volutions, somewhat depressed at the upper part and convex below; volutions ornamented by numerous concentric striæ, decussated by the still finer lines of growth, forming a series of quadrangular meshes, and producing a neat and uniform reticulation; umbilicus large; mouth transverse.

This fine and large *Pleurotomaria*, measuring 2½ inches across the base, is nearly equal in size to the *P. delphinuloides* Goldf., figured in the *Geol. Trans.* vol. vi. t. 33. f. 4. It very closely resembles the perfect specimens of *P. reticulata*, from the Kimmeridge clay of Wootton Basset (England), both as regards the squarish form of the volutions and the general markings; from that species it rather differs in size, and in the somewhat depressed and central position of the mesial band.

Locality. — Illawara (New South Wales).

I have observed in a fragment of the rock from the deposit at Illawara, a well-defined impression of another species of *Pleurotomaria*, nearly related to *P. conica* Phillips, in having a bicarinated mesial band, and numerous small, oblique, rather acute striæ on each volution; it differs however from that species in being smaller, more elongated, and acutely conical.

HETEROPODA.

Bellerophon micromphalus. (Pl. XVIII. fig. 7.)

Discoid, convex, with a minute umbilicus; aperture lunate, short, depressed by the preceding whorl; lip thickened, with a deep sinus in the front.

This shell has very much the aspect of a Goniatite, but I have not been able to detect septa in any of the specimens hitherto examined. The lines of growth form very fine slightly elevated ridges on the surface, curving backwards from the minute umbilicus. It somewhat resembles *B. stamineus* Conrad, but the aperture is rather less expanded.

Locality. — Illawara (New South Wales).

PTEROPODA.

THECA. (*J. de C. Sowerby.*)

General form elongate, pyramidal, obscurely three-sided, straight, one side generally flattened; external surface either smooth or transversely or longitudinally striated.

This genus has been instituted (in MS.) by Mr. James Sowerby, for the reception of certain forms having considerable resemblance to the genus *Creseis* among the *Pteropoda*, and probably belonging to the same family.

The *Orthoceras triangulare* Portlock, t. 28 A. fig. 3., as well as the form represented in t. 29. f. 6, 7., may belong to this genus, and other species are found in the silurian strata.

Theca lanceolata. (Pl. XVIII. fig. 8.)

Shell elongate, gradually tapering; section obtusely trigonal, surface marked with numerous transverse striæ, which become arched as they pass over the posterior (?) portion of the shell.

In the cast of the flattened sides of the shell, a somewhat obtuse ridge may be observed, not visible on the exterior surface. Length, 2 inches; diameter at top, nearly half an inch.

This species offers, by its form, a passage into the *Conulariæ*, and is near to *C. elongata* Portlock.

Locality. — Illawara (New South Wales).

Conularia levigata. (Pl. XVIII. fig. 9. *a. b.*)

Shell smooth, elongate, pyramidal, rectangular, gradually decreasing, two of the faces larger than the other two; faces slightly concave, longitudinally sulcated at the lateral angles, ornamented with equal transverse ridges, forming a slightly obtuse angle in the mesial furrow, where they alternate with each other; ridges terminating at the bottom of the lateral channels, curving slightly upwards, and alternating with each other, producing a somewhat granulated ridge.

In the species of *Conularia* from the carboniferous and silurian strata of England, the section of the pyramid is quadrangular, which form is also observed in those from the Devonian strata of the Rhenish provinces. M. Roemer has figured another species, *C. acuta*, in which the sides are unequal, producing a lozenge-shaped section; and subsequently M. De Koninck has described one, *C. irregularis*, from the carboniferous limestone of Belgium, of a similar figure. The above-described species from Australia is therefore interesting; for although two of the sides are larger than the adjacent ones, the section is rectangular, and not rhomboidal. This species differs from the *C. irregularis*, not only in the form of the section, but in the transverse ridges alternating in the centre of the faces, and not being continuous over them, as represented by De Koninck in that species.

The number of transverse ridges within a certain space (half an inch), differs from those *Conulariæ* previously described. If the figures carefully represent these markings, in *C. ornata* there are 12; *C. Gervillei*, 20; *C. Brongniartii*, 13; *C. irregularis*, 15; in a specimen of *C quadrisulcata*, from Coalbrook Dale, 25; one from near Glasgow, 20; in our species, *C. levigata*, 16. The ridges and intervening spaces are apparently smooth.

Locality.—Illawara and Raymond Terrace (New South Wales).

CEPHALOPODA.

ORTHOCERAS.

Shell elongate, conical, gradually tapering; section somewhat oval; septa numerous, concave, slightly undulated; siphuncle circular, large, nearly marginal.

The imperfect state of preservation of the specimen prevents the defining of any good specific character. In general form it approaches the *O. undulatum* Sow.; the shell very gradually increases in size, the septa being about a quarter of an inch apart. Diameter of largest portion, 2 inches.

Locality. — Yass Plains, New South Wales.

CRUSTACEA.

Bairdia affinis. (Pl. XVIII. fig. 10.)

Shell obtusely fusiform, tapering at both ends.

This species appears to be intermediate between the *Bairdia curtus* and *B. gracilis* (M'Coy); it is, however, not so fusiform as the former, and the posterior end not turncate, as in the latter species. In the same stratum are also found numerous specimens of a species of *Cythere*, too much compressed for correct determination.

Locality. — A dark bituminous limestone, from Booral.

PISCES.

Of this family have been observed some specimens of an Icthyodorulite, very much resembling the one figured in Mr. Prestwich's *Memoir on the Geology of Coalbrook Dale;* they are found at Booral, with the minute crustaceans above noticed, and *Littorina filosa.*

General Observations.—In the notice of the ancient flora of the Australian continent, an allusion was made to the absence of certain characteristic forms generally found in the carboniferous system of northern Europe. In directing the attention to the fossil contents of the series of strata immediately underlying these plant-bearing deposits, a stiking general resemblance is at once perceptible to many forms occurring in some divisions of the Palæozoic system of the northern region. Viewed as a whole, that is, including the Palæozoic series of New South Wales and Van Diemen's Land, a great variation appears to have taken place in the mechanical and chemical conditions of the deposits in different localities, apparently producing a modifying influence on the distribution of the organised beings. Mr. Darwin, in speaking of Van Diemen's Land, remarks, — " The strata containing these remains are singular, from the extreme variability of their mineralogical composition. Every intermediate form is present, between flinty slate, clay slate passing into greywacke, pure limestone, sandstone, and porcelanic rock; and some of the beds can only be described as composed of siliceo-calcareo clay slate." Some portions of the limestone from Mount Wellington cannot be distinguished from the ordinary Derbyshire mountain limestone.

Although the species constituting the Palæozoic fauna of Australia, &c., are not very numerous, it may perhaps, be interesting to offer a few short remarks respecting them, under the following divisions: —

1. *Their numerical proportion and zoological characters.*
2. *Their local distribution.*
3. *Their comparison with other species from the Palæozoic system of Europe and America.*
4. *To estimate the position that the deposit containing them occupies in the geologic series.*

The numerical proportion of the organic remains, as far at least as they appear to be known at present, are about 48, — a very small proportion, indeed, as compared with the European Palæozoic fauna. Of these, 10 belong to *Polyparia*, 14 to *Conchifera*, 12 to *Brachiopoda*, 7 to *Gasteropoda*, 1 to *Heteropoda*, 2 to *Pteropoda*, and 2 to *Crustacea ;* and also some remains of fishes.

These are variously distributed: thus, in the Illawara district, New South Wales, the preponderance of the bivalve Mollusca, *Pachydomus*, &c., and numerous individuals of the gasteropodous genera, as *Pleurotomaria*, *Platyschisma*, &c., with here and there a *Brachiopod*, and some traces of *Polyparia* (*Stenopora crinita*, Lonsdale), lead us to infer that the chemical and mechanical conditions were favourable to their developement, and that the deposits containing them may have been littoral, or accumulated at no great distance from the ancient shore. On the other hand, the coarse sand-rock of Raymond Terrace appears to have been rather unfavourable to the existence of the Testacea, not any of the *Conchifera* or *Gasteropoda* previously mentioned being there to be found; fragments of *Polyparia*, similar to those in Van Diemen's Land, a *Conularia*, and two or three species of *Brachiopoda*, being but sparingly distributed, owing their position, probably, to the drifting by tidal currents. The Booral deposit is interesting, as leading to a different state of things: it is a dark flaggy rock, or bituminous limestone, containing none of the principal genera above noticed; but numerous remains of species referred to *Littorina* and *Turritella*, with fragments of Icthyodorulites, and abundant traces of the minute crustaceous genera *Bairdia* and *Cythere*, the latter forming regular layers in the limestone, just as they are found deposited in the carboniferous shales near Halifax in Yorkshire and other parts of England, and Ireland.

In Van Diemen's Land, where, as previously adverted to, the strata are extremely variable, the chief fossiliferous deposit appears to be Mount Wellington and some adjacent localities: in these we find the different species of *Brachiopoda* attaining a much greater numerical developement than in the corresponding series on the Australian continent; the *Productus Brachythærus*, *Spirifer avicula*, *S. vespertilio*, and other species, are extremely abundant, some of them being of considerable size. Associated with these are numerous traces of fine and large specimens (and in some places filling the rock in every direction) of the different species of *Polyparia*, as *Stenopora ovata* and *Tasmaniensis*, *Fenestella ampla*, *F. internata*, and *F. fossula*, &c.; while the remains of *Conchifera* and *Gasteropoda* are but rarely to be discovered; the locality at Spring Hill containing the largest proportion, with one species of *Polyparia*, the *Stenopora informis* (Lonsdale).

In comparing these forms with those from the Palæozoic series of other countries, we find some of them to be identical, and others to be representative species: the *Terebratula hastata* is the same as the English species; a Spirifer near to *S. glaber* (Mart.); the *Littorina filosa*, very closely allied to, if not identical with, *Loxonema sulcatula* (M'Coy); and the *Turritella tricincta*, near to

T. acicula (Phillips). Of representative forms, we have the *Spirifer crebristria*, allied to *S. glabristria* (Phil.); and *Athyris depressa* (M'Coy); the *Sp. Tasmaniensis*, to the *S. Pentlandi* (D'Orb), from the carboniferous limestone of Bolivia; and the *Sp. Stokesii*, near to a Kendal species. Of the winged Spirifers, the *S. avicula* and *S. vespertilio* belong to the group of *S. convoluta* (Phil.), and *S. extensa* (Sow.); and a variety of the *S. vespertilio* is very near to the *S. condor* (D'Orb), from the carboniferous deposit of Bolivia; and another to the *S. Lyellii* (De Verneuil). The Australian *Productæ* are allied to the English forms of that genus. Of the *Polyparia*, the *Fenestella* generally appear to be the representatives of some English and Irish species.

Having thus briefly alluded to the local distribution and general resemblances of the Australian Palæozoic fauna, it is important to remark the absence of certain genera (so far at least as our observations on different collections have extended), which are abundantly distributed in the equivalent deposits of northern Europe. Of the family *Cephalopoda*, no traces of the *Nautilus*, *Clymenia*, or *Goniatites* have hitherto been detected; nor have there been found any remains of the true *Leptænæ*, or scarcely of *Orthidæ* (one doubtful fragment from Booral excepted), genera, so characteristic of the Devonian and carboniferous strata of other countries. *Trilobites* appear to have been equally rare; and the Crustacean family is represented by two or three species belonging to Cypridiform genera. On the other hand, the presence of a species of *Bellerophon* and *Conularia*, seven or eight of *Spirifer*, and two or three belonging to the gibbose species of *Productus*, — the latter being forms generally found in the carboniferous limestone,—and these associated with carboniferous types of *Polyparia* and a few allied forms of *Conchifera* and *Gasteropoda*, —lead us to believe that the deposits containing them may probably belong to that division of the Palæozoic series usually termed carboniferous.

The above observations apply chiefly to the great mass of ancient fossiliferous strata of these countries; but it also appears, from the evidence of superposition brought forth in the Geological Section, as well as by the fossil organisms contained therein, that the deposits at Yass Plains and Shoalhaven, in New South Wales, are anterior to the other strata, and may probably be considered the equivalent of the Devonian system of Europe. The fossil species from these deposits are but imperfectly known: *Favosites Gothlandica*, another species of *Favosites*, and *Amplexus arundinaceus* (Lonsdale), fragments of *Orthoceras* and remains of *Trilobites*, have only at present been noticed. Thus, the Palœozoic series of Australia and Tasmania may be regarded as partly the equivalent of the Devonian and carboniferous system of other countries.

I cannot conclude these brief notes without remarking that many forms in these deposits may have been obliterated; and others so considerably altered, that it is rather difficult to institute careful comparisons, from the metamorphic action that has been induced on many of the strata by the intrusion of trappean dikes, and which appear to have been more frequent in Van Diemen's Land than in the corresponding series on the Australian continent.

PLEIOCENE FAUNA.

MOLLUSCA.

MOLLUSCA (described by Mr. G. B. Sowerby).

Cypræa eximia. (Pl. XIX. figs. 1, 2, 3.)

Testa ovato-ventricosa, crassiuscula, lævi, polita, anticè posticèque rostrata; rostri antici longioris tuberculis duobus dorsalibus; rostro postico levitèr reflexo; spiræ anfractibus duobus conspicuis; aperturâ elongatâ, angustâ, sinuosâ, ad utramque extremitatem canaliferâ, canali postico ascendente; labii externi margine interno dentato, dentibus posticis minoribus, anticis propè canalem subinconspicuis, interruptis; labii interni margine interno sulcis angustis transversis, interstitiis crassioribus, anticis longioribus; lateribus basalibus propè extremitates crassis, dorso versum marginatis.

A fossil Cowry, of a very remarkable form, bearing but a very slight resemblance to any of the hitherto known species, either recent or fossil. In general form it slightly resembles *Cypræa Scottii:* it may, however, be readily distinguished from that species by its lengthened anterior and posterior canals, by the two tubercles on the posterior dorsal part of the anterior canal, and by the very remarkable grooves or ribs of the inner edge of the inner lip. It was found in a muddy sand, in sinking a well to 140 feet in depth, at Franklin's Village, Van Diemen's Land, about fifteen miles from the sea.

Terebratula compta. (Pl. XIX. fig. 4.)

Testa lævis, tenuis, trapeziformis, marginibus lateralibus subincurvis, antico parvo obtuso, areâ cardinali magnâ, lineâ depressâ longitudinali ad utrumque latus; valvâ ventrali rotundato-trigonulâ, planulatâ, anticè subtruncatâ, depressione medianâ parvâ; valvâ dorsali longitudinaliter obtusissimè carinatâ; aperturâ ligamenti adhesionis parvâ, terminali, circulari.

Locality.—Port Fairy, New Holland, associated with casts of *Nucula*, *Lucina*, and some other species of *Testacea*, in an elevated beach.

Bulinus Gunnii. (Pl. XIX. fig. 5.)

Testa oblongo-ovalis, tenuissima anfractibus quatuor ad quinque, subventricosis, *lævigatis?* suturâ conspicuâ.

A species which resembles *Bulinus granulosus* in form, differing from that species, however, in being exceedingly thin. As we have only the cast of the inside, we cannot further describe it.

Locality.—In yellow limestone of Hobart Town.

This species has been named after Mr. Ronald Gunn, of Launceston, a gentleman who has materially contributed to our knowledge of the botany and natural history of Van Diemen's Land.

Helix Tasmaniensis. (Pl. XIX. fig. 6.)

Testa suborbicularis, subdepressa, tenuissima, anfractibus quatuor ad quinque, ventricosis, lævibus? ultimo extus subdeclivi; aperturâ ferè circulari, umbilico magno; labio tenui.

This species resembles several European and Australian species in its general form, though the form of its aperture and last volution come nearest to the American *Helix concava.*

Locality.—With the last species.

MAMMALIA.

The specimens belonging to this interesting class have been examined by Professor Owen, and by him described and illustrated in many publications, but particularly in his recent valuable *Descriptive and Illustrated Catalogue of the Fossil Organic Remains, &c., contained in the Museum of the Royal College of Surgeons of England.*

In that Catalogue, the Australian fossil *Mammalia* have been identified with the *Marsupialia*, and referred to the genus of —

Diprotodon.
Nototherium.
Macropus.
Hypsiprymnus.
Phascolomys.
Dasyurus.
Thylacinus.

We shall avail ourselves of the wonted liberality of Professor Owen, and supply the reader with an extract from his *Descriptive and Illustrated Catalogue*, relative to four specimens of bones belonging to *Diprotodon* and *Nototherium*, — animals new to naturalists.

Order Marsupialia.

Genus *Diprotodon*.

"The anterior extremity of the right ramus of the lower jaw of the *Diprotodon australis*, Owen, exhibiting the rough articular surface of the broad and deep symphysis, the base of the large incisive tusk, the second and third molars, and the socket of the first. The third molar is the most entire; its grinding surface is produced into two high subcompressed transverse ridges, placed one before the other; there is also a ridge along both the anterior and the posterior parts of the base of the crown. The exposed commencement of the fangs is invested with a thick coating of cement; a portion of this substance also remains in the interspace between the posterior eminence and its basal ridge; the enamel is thick and presents a rugose or finely reticulate and punctate exterior, the perforations being seen at the fractured margins to lead to smooth pits, extending a little way into the enamel. The antero-posterior diameter of this tooth is two inches, the transverse diameter is one inch three lines; the extent of the three sockets of the molars is four inches five lines; they progressively diminish in size from the third to the first. The second molar is much narrower than the third, but its crown seems also to have supported two principal transverse eminences, and an anterior and posterior basal ridge: its antero-posterior extent is one inch and a half; its tranverse diameter at the posterior division, where it is thickest, is nine lines: the coronal ridges are broken off. The first molar is lost; but its socket shows that it was implanted, like the other molars, by two fangs. The anterior part of the symphysis and crown of the large incisor are broken off; from the first molar to the fractured end measures six inches three lines; this part of the margin of the jaw manifests no trace of tooth or socket. The incisor tooth extends forwards and slightly upwards; it is subcompressed, measuring one inch and a half in the vertical diameter, and nearly one inch in transverse diameter; it has a partial coating of enamel, which extends over the inferior and the lower half of the exterior surface of the tusk; the enamel has the same rugose punctate outer surface as that of the molar teeth. The large size of the dental canal exposed by the posterior fracture of the ramus indicates the ample supply of vessels and nerves which minister to the growth and nutrition of the incisive tusk; the great depth of the symphysis of the jaw gives the required strength for the operations of the tusk, and space for its support, and for the lodgement of its large persistent matrix. The vertical diameter of the symphysis anterior to the molar series is four inches. The symphysial surface, contrasted with the molar teeth, seems enormous; its antero-posterior extent to the fractured end of the jaw is six inches, its vertical diameter three inches;

its direction is obliquely from below upwards and forwards, its upper or posterior margin nearly straight, its lower or anterior one convex; it stands out a very little way from the vertical plane of the inner surface of the ramus. The thickest part of the symphysis of the jaw does not exceed three inches; this is at its lower part, which is convex in every direction. The surface of the bone seems to have been naturally roughened by minute vascular grooves and ridges; it has been crushed and cracked. The ridge, which doubtless formed the anterior part of the base of the coronoid process, begins to stand out below the socket of the third grinder; the smooth abraded surface at the back of the posterior talon of that tooth indicates the pressure against a contiguous tooth in the portion of jaw which has been broken away.

"This symphysial portion of jaw differs in a striking degree from the corresponding part in the known existing or extinct Pachyderms, which have, like the Australian extinct Mammal, a single incisor tusk in each ramus of the lower jaw. In the young Mastodon the tusk is situated in a less deep, more suddenly contracted and more produced symphysis; the symphysis of the jaw in the Sumatran and incisive Rhinoceros is much less deep, and is broader in proportion; the peculiar deflection of the symphysis in the Dinotherium makes it differ still more strikingly from the Diprotodon, in which the incisive tusks of the lower jaw extended obliquely upwards. The sudden slope of the toothless margin of the jaw anterior to the molares distinguishes the existing Proboscidians, which have a smaller anchylosed symphysis and no lower tusks.

"In the proportion of the symphysial articulation to the molar teeth, I know of no quadruped that so nearly resembles the present large Australian fossil as the Wombat; but in this Marsupial that part of the ramus of the jaw is broader in proportion to its depth: in these dimensions, viz. the proportions of breadth to depth of the jaw supporting the anterior molares, the Kangaroo more resembles the Diprotodon; and the molars of the Kangaroo in their double roots and double-ridged crowns are those amongst the Marsupials which most nearly resemble the molars in the present gigantic fossil. But the still closer resemblance which the molars of the Tapir bear to those of the Diprotodon calls for further and more decisive evidence before the supposition of its marsupial nature can be entertained with probability.

"From the alluvial or newer tertiary deposits in the bed of the Condamine River, westward of Moreton Bay, Australia."

"The proximal half of the shaft of the right femur of a quadruped as large as that to which teeth of the *Diprotodon australis*, Nos. 1490 to 1497 inclusive, and the femur No. 1503, belonged.

"This fragment measures eleven inches in length, and three inches in breadth at the distal fractured end, where the circumference is seven inches and nine lines, the femur there not having begun to enlarge for the formation of the distal condyles. The long and narrow trochanter minor is developed from the posterior angle of the inner border of the upper expanded part of the fragment, and resembles in form that of the gigantic femur No. 1489, though it is more posterior in position: the base of the trochanter major begins to swell outwards and forwards from the anterior angle of the opposite border, and encroaches upon the anterior part of the shaft: it is relatively lower, and swells out more abruptly than in the femur No. 1489; there is no trace of a third trochanter. The post-trochanterian depression resembles that in No. 1489. The shaft of the present fossil is more flattened anteriorly than in No. 1503: this antero-posterior compression gives it the same resemblance to the femur of the Mastodon and Elephant as has been pointed out in the description of No. 1489. The large extinct phyllophagous Edentata manifest this character in an exaggerated degree: the Rhinoceros is the only genus amongst the ordinary Pachyderms in which the femur is flattened as in the great extinct Australian quadrupeds, but the third trochanter effectually distinguishes that bone in the Rhinoceros. It is evident, from the differences above detailed between the present femur and No. 1503, that they belong to distinct though perhaps to nearly allied species. The form of the transverse section of the shaft is more regularly elliptical, and the anterior surface more flattened, in the present fragment than in No. 1503, which, from its closer resemblance with No. 1489, might well have belonged to a young individual of the same species."

Genus *Nototherium*.*

" The right ramus, with the symphysis of the lower jaw, of the *Nototherium inerme*, Owen, a quadruped apparently manifesting another pachydermal modification of the marsupial type.

" The dentition in the present jaw consists of molar teeth exclusively, four in number, which increase in size as they approach the posterior part of the series: a small portion of the anterior end of the symphysis is broken away, but there is no trace there of the socket of any tooth, and it is too contracted to have supported any tusk or defensive incisor. The length of the jaw is eleven inches: the molar series, which commences one inch in advance of the posterior border of the symphysis, is six inches in extent; each tooth is implanted by two strong and long conical fangs, the hindermost being the largest, and both being longitudinally grooved upon the side turned to each other. The first tooth is wanting, and the crowns of the rest are broken away: the base of the third remains, which gives an indication of a middle transverse valley, which most probably separated two transverse eminences. This jaw resembles that of the proboscidian Pachyderms in the shortness of the horizontal ramus; and of the Elephant more particularly in the rounding off of the angle, and in the convex curvature of the lower border of the jaw from the condyle to the symphysis, and also in the smaller vertical diameter of the symphysis, and the more pointed form of that part. It resembles the jaw of the elephant in the form, extent, and position of the base of the coronoid process; but it differs from the Elephant in the concavity on the inner side of the posterior half of the ramus of the jaw, which is formed by an inward inflection of the angle: this concavity extends forwards beneath the sockets of the last two molar teeth. It differs from the Elephant in the greater flatness of the outer part of the angle of the jaw, in which respect it more resembles the Mastodon. In the extent of the angle of the jaw it is intermediate between the Mastodon and Elephant. It differs from both in the inward bending of that angle, which is remarkable for the great longitudinal extent along which the inflection takes place: most of the inflected angle has been broken away, but enough remains to demonstrate a most instructive and interesting correspondence between the present fossil and the characteristically modified lower jaw in the marsupial animals. In pursuing the comparison of the Australian pachydermal fossil with the Mastodon and Elephant, we may next observe, that the alveolar process on the inner side of the base of the coronoid, behind the last molar, is as well developed as in the Mastodon; a similar angular production of this part exists in the Wombat and Kangaroo. The vertical extent of the outer concavity of the coronoid process is greater in the Australian fossil than in the jaw of the Mastodon, and is less clearly defined below, in which respect the Notothere resembles more the Elephant. The dental canal commences by a foramen penetrating the ridge which leads from the condyle to the post-molar process, and apparently just below the condyle, as in the Elephant, but it is relatively much smaller: it does not communicate with any canal leading to the outer surface of the ascending ramus, as in the Wombat and Kangaroo; but this external opening is not present in all Marsupialia.

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* *νότος the south, θηρίον beast.*

" The anterior outlet of the dental canal is smaller than in the Mastodon, and more anterior in position, and so far resembles the Elephant. The number, and apparently the form of the teeth, approximate the Australian Pachyderm more closely to the Mastodon than to the Elephant; but the equal size of the last and penultimate teeth, which had the same number of divisions of the crown, are points in which the Nototherium still more nearly resembled the Diprotodon, the Tapir, and Kangaroo.

" In the general shape of the jaw, however, the Nototherium differs widely from all existing Marsupials, and all known ordinary Pachyderms, and in the chief of these differences it resembles the lower jaw of the Proboscidians. It resembles these, however, in common with the Wombat, in the forward slope and curvature of the posterior margin of the ascending ramus extending from the condyle to the angle, in the inward production of the post-molar process, in the position of the base of the coronoid process, exterior to the hinder molar, in the thickness of the horizontal ramus as compared with its length, and the convexity of its outer surface; and it also resembles the Proboscidians, in common with the Kangaroo, in the small number of the grinding teeth.

"From the lower jaw of the Kangaroo and Wombat that of the Nototherium differs in the absence of the deep excavation on the outer side of the ascending ramus, which, in those Marsupials, leads to a perforation in the base of that part of the jaw, and it also differs in the inferior depth of the inner concavity and the inferior extent of the inward production of the angle of the jaw; besides the more important difference in the absence of the large incisor tooth. From the jaw of the Diprotodon, No. 1460., the present fossil differs in the much smaller vertical extent of the symphysis, and in the convexity of the jaw at its outer and anterior part, and more particularly in the absence of the incisive tusk and its socket; but it must have closely resembled the Diprotodon in the general form and proportions of the molar teeth.

"From the alluvial or newer tertiary deposits in the bed of the Condamine River, west of Moreton Bay, Australia."

"The astragalus of a large marsupial quadruped, probably the *Nototherium inerme*. The peculiarities of this astragalus will be obvious to the comparative anatomist from the following description. It is a broad, subdepressed, and subtriangular bone, the angles being rounded off, especially the anterior one; the upper or tibial surface is quadrate, concave from side to side, in a less degree convex from before backward: a ridge extending in this direction divides the tibial from the fibular surface, which slopes outwards at a very open angle, and maintains a nearly horizontal aspect, presenting an oblong trochlea for the support of the fibula, shallower, and one-third smaller than that for the tibia. The tibial articular surface is not continued upon the inner side of the astragalus, but its anterior and internal angle, which becomes convex in every direction, is directly continued into the anterior scaphoidal convexity, which sweeps round a deep and rough depression, dividing the outer and anterior part of the tibial trochlea from the corresponding half of the scaphoidal convexity; this has the greatest vertical extent at its inner part, where it is separated by a narrow rough transverse channel from the part which rested upon the os calcis. The calcaneal surface is single, and covers almost the whole of the under part of the astragalus: the greatest proportion of it is flat and reniform; an angular tuberosity or process being continued from the concave margin, where the pelvis of the kidney, to pursue the comparison, would be situated. This process must be received into a corresponding depression at the outer part of the articular surface upon the calcaneum. On the inner margin of the flat calcaneal surface opposite the tuberosity, a small triangular flattened surface is continued upwards upon the inner and posterior side of the astragalus, and nearly touches the inner and posterior angle of the tibial trochlea.

"The length of this fossil astragalus is four inches eight lines; its breadth is three inches five lines; its depth (at the base of the scaphoidal convexity) is two inches and a half. We look in vain amongst the

Pachyderms with astragali of corresponding dimensions for the uniform and prominent convexity of the anterior articulation, for its continuation with the tibial trochlea, and for the single and uninterrupted calcaneal tract on the lower surface of the bone. The Proboscidians, which approach nearest the present fossil in the depressed form of the astragalus and the flattening of the calcaneal articulation, have that articulation divided into two surfaces by a deep and rough groove: the scaphoidal surface is likewise similarly divided from the tibial trochlea; and no Pachyderm has the upper articular surface of the astragalus traversed by an antero-posterior or longitudinal ridge, dividing it from an almost horizontal facet for the support of the end of the fibula.

" The peculiar form of the astragalus in the Ruminants, and especially the trochlear character of the anterior or scapho-cuboidal surface, place it beyond the pale of comparison. In all the placental Carnivora the scaphoidal convexity is pretty uniform, and occupies the anterior extremity of the astragalus, as in Man and Quadrumana, but it is more produced and supported on a longer neck, which is also more oblique than in the Quadrumana, where the astragalus already begins to recede, in this character, from the Human type. In the Seals the upper surface of the astragalus somewhat resembles the present fossil in the meeting of the tibial and fibular facets at an obtuse angle formed by a longitudinal rising, but the fibular surface is rather the wider of the two, and the tibial one is divided by a broad rough tract from the scaphoidal prominence; and in addition to this anterior production of the bone there is also another process from its posterior part, which, as Cuvier remarks, gives the astragalus of the Seal the aspect of a calcaneum. By some of the remarkable peculiarities which the astragalus presents in the Order *Bruta*, it approaches the

Australian fossil under consideration; as in the Mylodon, for example, where the surface for the calcaneum is single and undivided. But in this great extinct leaf-eating quadruped the calcaneal facet is continued into the navicular facet, which, on the other hand, is separated by a rough tract from the tibial articulation, as in all the Edentata, recent and fossil. The latter character likewise distinguishes the astragalus of the Rodentia from the fossil astragalus under consideration.

"In the Ornithorhynchus the astragalus has a deep depression on its inner side for the reception of the incurved malleolus of the tibia, and in both the Ornithorhynchus and Echidna the tibial surface is more convex than in the present fossil.

"Amongst the existing Marsupialia, the astragalus in the largest herbivorous species, as the Kangaroos, offers very great differences from the present Australian fossil; the broad and shallow trochlea for the tibia is continued upon the inner side of the bone into a cavity which receives the internal malleolus; whilst the fibular facet is long and narrow, and situated almost vertically upon the outer side of the bone. The scaphoidal surface is unusually small, and convex only in the vertical direction; and is divided by a vertical ridge into two surfaces, the outer one being applied to the os calcis. The inferior and proper calcaneal articulation is divided into two small distinct surfaces, the outer one concave, the inner one concavo-convex.

"Amongst the gradatorial and pedimanous Marsupials, and herein more especially the Wombat, we at length find a form of astragalus which repeats most closely the characters of the extraordinary fossil under consideration: in the astragalus of the Wombat the fibular facet, of a subtriangular form, almost as broad as it is long, slightly slopes at a very open angle from the ridge which divides it from the tibial surface: this surface, gently concave from side to side, and more gently convex from behind forwards, repeats the more striking character of being directly continued by its inner and anterior angle with the large and transversely extended convexity for the os scaphoides. The calcaneal surface below is single and continued uninterruptedly from the back to the fore-part of the outer half of the under surface; and its outermost part is produced into an angle, which is received into a depression at the outer side of the upper articular surface of the calcaneum. Thus all the essential characters of the fossil are repeated in the astragalus of the Wombat. The differences are of minor import, but are sufficiently recognisable; thus, in the Wombat, the single calcaneal surface is directly continued into the cuboido-scaphoidal convexity, instead of being separated from it by a narrow rough tract, as in the fossil; the calcaneal surface is also narrower than in the fossil, and the outer angle is less produced: the division of the tibial trochlea for the inner malleolus is better defined in the Wombat, and the depression round which the continuous smooth surface between the tibial and scaphoid surfaces winds is less deep in the Wombat; the scaphoidal convexity is also less developed in the vertical direction in the Wombat.

"We thus find that the great fossil astragalus from Australia, viewed in reference to the general characters of that bone in the mammalian class, offers great and remarkable peculiarities; and we further find that these are exclusively, but most closely repeated in certain Australian genera of Marsupialia, and especially in the bulkiest of the existing vegetable feeders, which are not saltatorial. The inference can hardly be resisted, that the rest of the essential peculiarities of the marsupial organisation were likewise present in that still more bulky quadruped, of which the fossil under consideration once formed part.

"In the Kangaroo and the smaller leaping Marsupials the fibula is disproportionately slender and immoveably attached or anchylosed to the tibia, reminding one of the Ruminant type of organisation; it sustains little if any of the superincumbent weight, and has no resting-place upon the astragalus, the outer malleolus being simply applied to the vertical outer surface of that bone. The broad and nearly horizontal surface in the present fossil clearly bespeaks the existence in the same animal of a fibula which must have almost equalled the tibia in size at its distal end, and have taken as large a share in the formation of the ankle-joint as it does in the Wombat: we may in like manner infer that the tibia and fibula were similarly connected together, and, coupling this with the ball-and-socket joint between the scaphoid and astragalus, we may conclude that the foot of the great extinct Marsupial possessed that degree of rotatory movement which, as enjoyed by the Wombat, is so closely analogous to the pronation and supination of the hand. We finally derive from the well-marked marsupial modifications of the present fossil astragalus, a corroboration of the inferences as to the former existence in Australia of a marsupial vegetable-feeder as large as the Rhinoceros, which have been deduced from the inflected angle and other characters of the jaw of the Diprotondon and the Nototherium, and from the fossil calcaneum, No. 1485, which has been referred to the Diprotodon. The present bone closely agrees in all its marsupial modifications with that calcaneum, but the single flat surface which articulated with the calcaneum is longer in proportion to its breadth than in No. 1485. From this circumstance, and the close agreement in colour and general condition which the present astragalus has with the jaw of the Nototherium, No. 1505, it more probably belongs to that genus; but for demonstration further discoveries will be required of parts of the skeleton so associated as to justify the inference that they had belonged to one individual.

"The present bone is from the alluvial or newer tertiary deposits in the bed of the Condamine River, west of Moreton Bay, Australia."

To these relics may be added a molar bone of the Mastodon, similar to the *Mastidon angustinis*, and provisionally called, by Professor Owen, *Mastodon australis*, and which I bought from a native at Boree, the sheep station of Captain Ryan, through the agency of the overseer of that station. The native, in giving the bone, stated that similar ones, and larger still, might be got further in the interior; but that, owing to the hostility of a tribe, upon whose grounds the bones are to be found, it was impossible for him to venture in that time in search for more: as, however, he promised to exert himself at some future period, in order to supply me with some better specimens, I have left a reward with the man second in command of the station, and which was to be given to the native on his redeeming his pledge.

Should future enterprise lead travellers to that quarter, it will be deserving their while to push the inquiry farther, and add more evidence regarding the existence of the Mastodontoid animals in New Holland.

RECENT FAUNA.

That *rara avis*, the Black Swan, which was discovered by Vlaming, as far back as 1697, may be looked upon as the precursor of those splendid collections with which Banks, Solander, Labillardière, Menzies, Brown, Perron, Lessueur, Bailly, P. P. King, Gunn, Backhouse, and Gould enriched the cabinets of Europe, and to which we trace our first notions of Australian zoology.

Prior to 1824, the accounts of that zoology, which had been published, were limited to monographs and isolated descriptions, laid from time to time before the English and Continental public.

In the above-mentioned year a more complete view of the Australian zoology was given. Capt. P. P. King, R.N., in his valuable Appendix to the Narrative of the Australian Survey, embraced all its branches in one systematic outline, to which the names of the eminent naturalists, William Sharp, Macleay, and John Edward Gray, who determined and classified the specimens, give an additional importance.

In that Appendix, the *Mammalia* comprise 6 species; the *Aves*, 14; the *Reptilia*, 9; the *Pisces*, 7; the *Annulosa*, 192; the *Radiata*, 5; the *Acrita*, 25; and, finally, the *Mollusca*, 111.

Since then, the contributions and additions secured to several of the grand divisions of the animal kingdom, render their illustration nearly complete: to the illustration of some others, such additions are still sadly wanting.

In justice to those who have so zealously and perseveringly promoted our knowledge of these distant regions, now of such importance to colonisation, and in order to furnish a guide to those whose zeal may enable us hereafter to extend still farther our information in a department where so much has still to be learnt, we shall briefly give the sum of our zoological knowledge of the Australian continent up to the present day, whereby will be seen what has already been done, and what remains to do.

MAMMALIA.

With the following list of Mammals, inhabiting New South Wales, Van Diemen's Land, and Bass's Straits, as also with that of Birds, I was kindly favoured by John Gould, Esq. F.R.S.

CHEIROPTERA.

Rhinolophus megaphyllus *Gray*. N. S. W. and V. D. L.

Nyctophilus Geoffroyii *Leach?* N. S. W. generally, and V. D. L.

Scotophilus Gouldii *Gray*. N. S. W. and V. D. L.

——— Australis *Gray*. N. S. W. generally, and V. D. L.

——— pumilus *Gray*. Interior of N. S. W. generally. Flies over rivers and pools, close to the surface.

FERÆ.

Canis familiaris Australasiæ. (The Dingo.) N. S. W. generally, not V. D. L.

Octaria Perronii *Desm*. (Perron's Seal). The rocky coasts of N. S. W., V. D. L., and the islands in Bass's Straits.

GLIRES.

Hydromys chrysogaster *Geoff*. N. S. W. and V. D. L.

Pseudomys Australis *Gray*. Liverpool Plains, N. S. W.

Mus fuscipes *Waterh*. N. S. W.

—— setifer *Horsf*. V. D. L.

——? platurus *Mitch*. N. S. W.

——? Hovellii *Mitch*. N. S. W.

Hapalotis albipes *Licht*. Port Philip.

——— Mitchellii *Gray*. Interior of N. S. W.

MARSUPIALIA.

Thylacinus cynocephalus *Fisch.* V. D. L. only. (Tiger of colonists.)
Diabolus ursinus *Harris.* V. D. L. only. (The Devil of colonists.)
Dasyurus maculatus *Shaw.* V. D. L. only.
———— Geoffroyii *Gould.* Interior of N. S. W. Common on the Liverpool and other high ranges.
———— viverrinus *Shaw.* N. S. W. and V. D. L.
Phascogall penicillata *Shaw.* N. S. W. generally.
Antechinus affinis *Gray.* V. D. L.
———— flavipes *Waterh.* N. S. W.
Red Shrew Mouse of *Mitchell's* Trav. genus ? Interior of N. S. W.
Perameles Gunnii *Gray.* V. D. L. only.
———— fasciata *Gray.* Interior of N. S. W.
———— nasuta *Geoff.* N. S. W.
———— obesula ? *Shaw.* N. S. W. and V. D. L.
Chœropus castanotis *Gray.* Plains to the north-west of N. S. W.
Phalangista vulpina *Shaw.* N. S. W. generally.
———— fuliginosa *Ogilby.* V. D. L. only.
———— canina *Ogilby.* Ranges towards the interior of N. S. W.
Hepoona Cookii *Gray.* V. D. L. There are two, if not three, species confounded under this name; and it is consequently uncertain to which of them it applies.
Dromicia gliriformis (Phalangista gliriformis *Bell*) V. D. L.
Petaurus Taguanoïdes *Desm.* N. S. W.
Belideus flaviventer *Desm.* Brushes of N. S. W.
———— sciureus *Shaw.* N. S. W. generally.
———— breviceps *Waterh.* N. S. W.
Acrobates pygmæus *Desm.* N. S. W.

Macropus major *Shaw.* N. S. W. and V. D. L.
——— frænatus *Gould.* Plains of interior of N. S. W.
Osphranter robustus *Gould.* Mountain ranges of N. S. W.
——— ? lanigerus. (Macropus laniger *Less.*) Plains of N. S. W.
Halmaturus Bennettii *Waterh.* V. D. L. and islands in Bass's Straits.
——— Ualabatus *Less.* Brushes of N. S. W.
——— ruficollis *Less.* N. S. W.
——— Parryii *Bennett.* N. S. W.
——— Billardièri *Desm.* V. D. L.
——— Eugenii *Gray.* Brushes of N. S. W.
——— Parma *Gould.* Brushes of Illawara.
——— dorsalis *Gray.* Stony ridges of interior of N. S. W.
Petrogale penicillata *Shaw.* Rocky mountains of N. S. W.
Lagorchestes Leporoïdes *Gould.* Plains of interior of N. S. W.
Bettongia setosa *Gray.* N. S. W.
——— Whitei . N. S. W.
——— rufescens *Gray.* N. S. W.
——— cuniculus *Ogilby.* V. D. L.
Hypsiprymnus minor *Cuv.* N. S. W. This or a nearly allied animal inhabits V. D. L.
Phascolarctos cinereus *Fisch.* (The Koala.) Brushes of N. S. W. generally.
Phascolomys ursinus . (The Wombat.) N. S. W. and V. D. L.

MONOTREMATA.

Echidna aculeata . N. S. W.
——— setosa . V. D. L.
Ornithorhynchus paradoxus *Blum.* Ornithorhynchi are common in the rivers of the eastern portion of N. S. W. as well as in those of V. D. L., and

doubtful whether there be not more than one species, as specimens procured in V. D. L. differ from those obtained in N. S. W.

AVES.

RAPTORES.

Aquila fucosa *Cuv.* N. S. W., V. D. L., and I. in B. S.
——— Morphnoïdes *Gould.* N. S. W. interior.
Ichthyiaëtus leucogaster *Gould.* N. S. W., V. D. L., and I. in B. S.
Syn.—Falco leucogaster *Lath.*
Haliastur leucosternus *Gould.* Brushes of N. S. W.
Pandion leucocephala *Gould.* V. D. L., I. in B. S., and coasts of N. S. W.
Falco melanogenys *Gould.* N. S. W., V. D. L., and I. in B. S.
—— frontatus *Gould.* N. S. W., V. D. L., and I. in B. S.
Ieracidea Berigora *Gould.* N. S. W., V. D. L., and I. in B. S.
Syn. Falco Berigora *Vig.* and *Horsf.*
Tinnunculus Cencroïdes *Gould.* N. S. W.
Syn. Falco Cencroïdes *Vig.* and *Horsf.*
Astur approximans *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
——- Novæ-Hollandiæ *Vig.* and *Horsf.* N. S. W.
Syn. Falco Novæ-Hollandiæ *Gould.*
——- albus *Jard.* and *Selb.* N. S. W., V. D. L., and I. in B. S.
Syn. Falco albus *Shaw.*
Accipiter torquatus *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Buteo melanosternon *Gould.* Interior of N. S. W.
Milvus isurus *Gould.* N. S. W.
——— affinis *Gould.* N. S. W.

Elanus axillaris *Gould*. N. S. W.
Syn. Falco axillaris *Lath.*
Lepidogenys subscristatus *Gould*. Brushes of N. S. W.
Circus assimilis *Jard.* N. S. W. and V. D. L.
—— Jardinii *Gould*. N. S. W.
Strix personata *Vig.* N. S. W.
—— castanops *Gould*. V. D. L.
—— cyclops *Gould*. N. S. W.
—— delicatulis *Gould*. N. S. W.
Athene strenua *Gould*. N. S. W.
——— fortis *Gould*. N. S. W.
——— Boobook . N. S. W.
——— maculata . V. D. L.

INSESSORES.

Hirundo neoxena *Gould*. N. S. W., V. D. L., and I. in B. S.
Cotyle Ariel *Gould*. N. S. W.
—— pyrrhonota. N. S. W., V. D. L., and I. in B. S.
Acanthylis caudacuta. N. S. W., V. D. L., and I. in B. S.
Cypselus Australis *Gould*. N. S. W.
Eurostopodus guttatus. N. S. W.
————— albogularis *Gould*. N. S. W.
Podargus humeralis *Vig.* and *Horsf.* N. S. W.
———— Cuvieri *Vig.* and *Horsf.* V. D. L.
Ægotheles Novæ-Hollandiæ *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Eurystomus Australis *Swains.* N. S. W.
Merops ornatus *Lath.* N. S. W.
Dacelo gigas *Bodd.* N. S. W.
Halcyon sanctus *Vig.* and *Horsf.* N. S. W.
——— pyrrhopygia *Gould*. N. S. W.
Alcyone azurea. N. S. W.
Dicrurus bracteatus *Gould*. N. S. W.

Falcunculus frontatus *Vig.* and *Horsf.* N. S. W.
Oreoïca gutturalis. N. S. W.
Colluricincla cinerea *Vig.* and *Horsf.* N. S. W.
———— Selbii. V. D. L.
Pachycephala gutturalis *Vig.* and *Horsf.* N. S. W.
———— olivacea *Gould.* V. D. L.
———— pectoralis *Vig.* and *Horsf.* N. S. W.
———— glaucura *Gould.* V. D. L.
Artamus sordidus. N. S. W., V. D. L., and I. in B. S.
——— minor *Vieill.* N. S. W.
——— superciliosus *Gould.* N. S. W.
——— leucopygialis *Gould.* N. S. W.
Cracticus destructor *Temm.* N. S. W. and V. D. L. ?
———— nigrogularis *Gould.* N. S. W.
Gymnorhina hypoleuca *Gould.* N. S. W. and V. D. L.
———— Tibicen *G. R. Gray.* N. S. W.
Stepera fuliginosa *Gould.* V. D. L.
——— graculina *Less.* N. S. W.
——— (Another species) . V. D. L.
Grallina melanoleuca *Vieill.* N. S. W.
Campephaga humeralis *Gould.* N. S. W.
———— tenuirostris . N. S. W.
Graucalus melanops *Vig.* and *Horsf.* N. S. W.
———— parvirostris *Gould.* V. D. L.
———— mentalis *Gould.* N. S. W.
———— Swainsonii *Gould.* N. S. W.
———— Phasianellus . N. S. W.
Pitta strepitans *Temm.* Brushes of N. S. W.
Mimeta viridis *King.* N. S. W. generally.
Sphecotheres Australis *Swains.* Brushes of N. S. W.
Oreocincla Novæ-Hollandiæ *Gould.* N. S. W. and V. D. L.
Cinclosoma punctatum *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Menura superba *Davies.* Brushes of N. S. W.

Psophodes crepitans *Vig.* and *Horsf.* Brushes of N. S. W.
Sphenostoma cristata *Gould.* Interior of N. S. W.
Malurus cyaneus *Vieill.* N. S. W. generally.
——— longicaudus *Gould.* V. D. L.
——— leucopterus *Quoy* and *Gaim.* Plains of interior of N. S. W.
——— Lamberti *Vig.* and *Horsf.* N. S. W.
——— melanocephalus *Vig.* and *Horsf.* N. S. W.
Stipiturus malachurus *Less.* N. S. W., V. D. L., and I. in B. S.
Amytis textilis . N. S. W.
——— striatus . N. S. W.
Dasyornis Australis *Vig.* and *Horsf.* N. S. W.
Cysticola exilis ? . N. S. W.
Hylacola pyrrhopygia *Gould.* N. S. W.
Acanthiza Diemenensis *Gould.* V. D. L.
——— Ewingii *Gould.* V. D. L.
——— nana *Vig.* and *Horsf.* N. S. W.
——— Reguloïdes *Vig.* and *Horsf.* N. S. W.
——— lineata *Gould.* N. S. W.
——— chrysorrhœa . N. S. W.
Ephthianura albifrons *Gould.* N. S. W., V. D. L., and I. in B. S.
——— aurifrons *Gould.* N. S. W.
——— tricolor *Gould.* N. S. W.
Sericornis citreogularis *Gould.* N. S. W.
——— humilis *Gould.* V. D. L.
——— magnirostris . Brushes of N. S. W.
Origma solitaria *Gould.* Rock gullies of N. S. W.
Calamanthus striatus *Gould.* V. D. L.
——— ? minimus . N. S. W.
Anthus pallescens *Vig.* and *Horsf.* N. S. W. and V. D. L.
Cincloramphus cruralis . N. S. W.
——— cantillans . Port Philip.
——— rufescens . N. S. W.

Erythrodryas Lathami . V. D. L.
——— rosea . Brushes of N. S. W.
Petroica multicolor *Swains.* N. S. W., V. D. L., and I. in B. S.
——— phœnicea *Gould.* N. S. W., V. D. L., and I. in B. S.
——— Goodenovii *Jard.* and *Selb.* N. S. W., V. D. L., and I. in B. S.
——— bicolor *Swains.* N. S. W.
——— fusca *Gould.* V. D. L.
Eopsaltria Australis *Swains.* N. S. W.
Zosterops dorsalis *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Pardalotus punctatus *Temm.* N. S. W., V. D. L., and I. in B. S.
——— quadragintus *Gould.* V. D. L.
——— striatus *Temm.* N. S. W.
——— affinis *Gould.* V. D. L.
Dicæum hirundinaceum . N. S. W.
Amadina Lathami . N. S. W.
——— castanotis *Gould.* N. S. W.
Estrelda bella . N. S. W. and V. D. L.
——— Bichenovii . N. S. W.
——— temporalis . N. S. W.
——— modesta *Gould.* N. S. W.
——— ruficauda *Gould.* N. S. W.
——— cincta *Gould.* N. S. W.
Rhipidura albiscapa *Gould.* N. S. W. and V. D. L.
——— rufifrons *Vig.* and *Horsf.* Brushes of N. S. W.
——— Motacilloïdes . N. S. W.
Seisura volitans *Vig.* and *Horsf.* N. S. W.
Myiagra plumbea *Vig.* and *Horsf.* N. S. W.
——— nitida *Gould.* V. D. L.
Micrœca macroptera *Gould.* N. S. W.
Monarcha carinata *Swains.* N. S. W.
Gerygone albogularis *Gould.* N. S. W.
——— fusca *Gould.* N. S. W.

Smicrornis brevirostris *Gould.* N. S. W.
Corvus coronoïdes *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Chlamydera maculata *Gould.* N. S. W.
Ptilonorhynchus holosericeus *Kuhl.* Brushes of N. S. W.
——————— Smithii *Vig.* and *Horsf.* N. S. W.
Sericulus chrysocephalus *Swains.* Brushes of N. S. W.
Corcorax leucopterus *Less.* N. S. W.
Struthidea cinerea *Gould.* Interior of N. S. W.
Pomatorhinus trivirgatus *Temm.* N. S. W.
——————— temporalis *Vig.* and *Horsf.* Interior of N. S. W.
Cacatua galerita *Vieill.* N. S. W. and V. D. L.
——— Leadbeateri *Wagl.* Interior of N. S. W., back of Port Philip.
——— Eos *Wagl.* Interior of N. S. W.
Licmetis nasicus *Wagl.* Interior of N. S. W.
Calyptorhynchus Banksii *Vig.* and *Horsf.* N. S. W.
————————— Leachii . N. S. W.
————————— funereus *Vig.* and *Horsf.* N. S. W.
————————— xanthonotus *Gould.* V. D. L.
Corydon galeatus *Wagl.* N. S. W.
Polytelis Barrabandi . N. S. W.
——— melanura . N. S. W.
Aprosmictus scapulatus *Gould.* N. S. W.
——————— erythropterus *Gould.* Interior of N. S. W.
Platycercus Barnardi *Vig.* and *Horsf.* Interior of N. S. W.
——————— Pennantii *Vig.* and *Horsf.* N. S. W.
——————— flaviventris *Vig.* and *Horsf.* V. D. L.
——————— flaveolus *Gould.* Interior of N. S. W.
——————— palliceps *Vig.* N. S. W.
——————— eximius *Vig.* and *Horsf.* N. S. W.
——————— multicolor *Vig.* and *Horsf.* N. S. W.
——————— hæmatogaster *Gould.* N. S. W.
——————— hæmatonotus *Gould.* N. S. W.
Melopsittacus undulatus *Gould.* N. S. W.

Euphema Bourkii . N. S. W.
——— venusta *Wagl.* V. D. L.
——— elegans *Gould.* N. S. W.
——— aurantia *Gould.* V. D. L.
——— pulchella *Wagl.* N. S. W.
Lathamus discolor *Gould.* V. D. L.
Nymphicus Novæ-Hollandiæ *Wagl.* N. S. W.
Pezoporus formosus *Ill.* N. S. W., V. D. L., and I. in B. S.
Trichoglossus Swainsonii *Jard.* and *Selb.* N. S. W. and V. D. L.
——— chlorolepidotus *Wagl.* N. S. W.
——— concinnus *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
——— pusillus *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Climacteris scandens *Temm.* N. S. W.
——— erythrops *Gould.* N. S. W.
——— picumnus *Temm.* N. S. W.
Ptiloris paradiseus *Swains.* N. S. W.
Orthonyx spinicaudus *Temm.* Brushes of N. S. W.
Sittella chrysoptera *Swains.* N. S. W.
Cuculus inornatus *Vig.* and *Horsf.* N. S. W. and V. D. L.
——— cineraceus *Vig.* and *Horsf.* N. S. W. and V. D. L.
Chalcites lucidus *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Eudynamys Orientalis ? *Vig.* and *Horsf.* N. S. W.
Centropus Phasianus *Vig.* and *Horsf.* N. S. W.
Scythrops Novæ-Hollandiæ *Lath.* N. S. W.
Meliphaga Novæ-Hollandiæ *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
——— sericea *Gould.* N. S. W.
——— Australasiana *Vig.* and *Horsf.* N. S. W.
Glyciphila fulvifrons *Swains.* N. S. W.
——— ocularis *Gould.* N. S. W.

Ptilotis chrysotis *Swains.* N. S. W.
——— sonora *Gould.* N. S. W.
——— flavigula *Gould.* V. D. L.
——— leucotis *Swains.* N. S. W.
——— auricomis *Swains.* N. S. W.
——— penicillata *Gould.* N. S. W.
——— fusca *Gould.* N. S. W.
——— chrysops *Swains.* N. S. W.
Plectorhyncha lanceolata *Gould.* N. S. W.
Zanthomya phrygia *Swains.* N. S. W.
Entomophila picta *Gould.* N. S. W.
Acanthogenys rufogularis *Gould.* N. S. W.
Anthochæra inauris *Gould.* V. D. L.
——— carunculata *Vig.* and *Horsf.* N. S. W.
——— mellivora *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
Tropidorhynchus corniculatus *Vig.* and *Horsf.* N. S. W.
——— citreogularis *Gould.* Interior of N. S. W.
Acanthorhynchus tenuirostris *Gould.* N. S. W., V. D. L., and I. in B. S.
Myzomela sanguineolenta . N. S. W.
——— nigra *Gould.* N. S. W.
Entomyza cyanotis *Swains.* N. S. W.
Melithreptes validirostris *Gould.* V. D. L.
——— melanocephala *Gould.* V. D. L.
——— lunulata, *Vieill.* N. S. W.
Myzantha garrula *Vig.* and *Horsf.* N. S. W., V. D. L., and I. in B. S.
——— flavigula *Gould.* Interior of N. S. W.
Manorhina viridis *Vieill.* Brushes of N. S. W.

RASORES.

Ptilinopus Swainsonii *Gould.* Brushes of N. S. W.
Chalcophaps chrysochlora *Gould.* Brushes of N. S. W.

Lopholaïmus Antarcticus *G. R. Gray.* Brushes of N. S. W.
Carpophaga leucomela . Brushes of N. S. W.
——— magnifica . Brushes of N. S. W.
Phaps chalcoptera . N. S. W., V. D. L., and I. in B. S.
—— histrionica *Gould.* Interior of N. S. W.
—— elegans . N. S. W., V. D. L., and I. in B. S.
—— scripta . Interior of N. S. W.
Geopelia cuneata . N. S. W.
——— Phasianella . Brushes of N. S. W.
Dromeceius Novæ-Hollandiæ *Vieill.* N. S. W. and V. D. L.
Otis Australasianus *Gould.* Plains of N. S. W.
Œdicnemus longipes *Vieill.* N. S. W.
Hæmatopus fuliginosus *Gould.* N. S. W., V. D. L., and I. in B. S.
——— longirostris *Vieill.* N. S. W., V. D. L., and I. in B. S.
Lobivanellus lobatus . N. S. W., V. D. L., and I. in B. S.
Sarciophorus pectoralis . N. S. W., V. D. L., and I. in B. S.
Charadrius Virginianus? . N. S. W. and V. D. L.
Hiaticula monacha . N. S. W., V. D. L., and I. in B. S.
——— nigrifrons . N. S. W., V. D. L., and I. in B. S.
——— bicincta . N. S. W., V. D. L., and I. in B. S.
——— ruficapilla . N. S. W., V. D. L., and I. in B. S.
Erythrogonys cinctus *Gould.* N. S. W.
Talegalla Lathami *Gould.* Brushes of N. S. W.
Turnix varius . N. S. W., V. D. L., and I. in B. S.

Turnix velox *Gould.* N. S. W.
——— pyrrhothorax *Gould.* N. S. W.
Coturnix pectoralis *Gould.* N. S. W., V. D. L., and I. in B. S.
Synoïcus Australis . N. S. W., V. D. L., and I. in B. S.
——— Sinensis . N. S. W.

GRALLATORES.

Grus Antigone ? . N. S. W.
Platalea regia *Gould.* N. S. W.
——— flavipes *Gould.* N. S. W.
Mycteria Australis *Swains.* N. S. W.
Ardea pacifica ? *Lath.* N. S. W.
——— Novæ-Hollandiæ *Lath.* N. S. W.
Nycticorax Caledonicus, *Less.* N. S. W.
Botaurus Australis *Gould.* N. S. W. and V. D. L.
Ardeola ——— . N. S. W.
Ibis strictipennis *Gould.* N. S. W.
—— spinicollis *Gould.* N. S. W.
—— Falcinellus *Linn.* N. S. W.
Numenius Australasianus *Gould.* N. S. W., V. D. L., and I. in B. S.
———— uropygialis *Gould.* N. S. W.
———— minutus *Gould.* N. S. W.
Recurvirostris rubricollis *Temm.* N. S. W.
Himantopus leucocephalus *Gould.* N. S. W.
Limosa . N. S. W. and V. D. L.
Terekia cinerea *Bonap. ?* N. S. W.
Totanus stagnatilis ? N. S. W.
Pelidna Australis. N. S. W. and V. D. L.
——— ——— ? like *P. minuta.* N. S. W.
Strepsilas collaris *Linn.* N. S. W., V. D. L., and I. in B. S.
Scolopax Hardwickii *Gray.* N. S. W., V. D. L., and I. in B. S.

Rhynchæa Australis *Gould.* N. S. W.
Porphyrio melanotus *Temm.* N. S. W., V. D. L., and I. in B. S.
Tribonyx Mortieri . V. D. L.
—— —— ventralis *Gould.* N. S. W.
Gallinula immaculata . N. S. W.
Rallus ——— ? V. D. L.
Porzana fluminea *Gould.* N. S. W., V. D. L., and I. in B. S.
——— palustris *Gould.* N. S. W., V. D. L., and I. in B. S.

NATATORES.

Cygnus atratus . N. S. W., V. D. L., and I. in B. S.
Anseranas melanoleuca . N. S. W.
Nettapus Coromandelianus . N. S. W.
Cereopsis Novæ-Hollandiæ *Lath.* N. S. W., V. D. L., and I. in B. S.
Casarka Tadornoïdes . N. S. W., V. D. L., and I. in B. S.
Biziura lobata *Shaw.* N. S. W., V. D. L. and I. in B. S.
Bernicla jubata . N. S. W.
Anas Novæ-Hollandiæ *Lath.* N. S. W., V. D. L., and I. in B. S.
—— castanea . N. S. W., V. D. L., and I. in B. S.
Nyroca Australis *Eyton.* V. D. L.
Rhynchapsis rhynchotis *Steph.* N. S. W., V. D. L., and I. in B. S.
Malacorhynchus membranaceus, *Swains.* N. S. W. and V. D. L.
Podiceps Australis *Gould.* N. S. W., V. D. L., and I. in B. S.
——— poliocephalus *Jard.* and *Selb.* N. S. W., V. D. L., and I. in B. S.

Podiceps gularis *Gould.* N. S. W., V. D. L., and I. in B. S.

Phalacrocorax pica. Rocky coasts of N. S. W.

—— leucogaster *Gould.* Rocky coasts of N. S. W. and V. D. L.

—— sulcirostris . Rivers of N. S. W.

—— melanoleucus . Rivers of N. S. W. and V. D. L.

Plotus Le-Vaillantii? . Rivers of N. S. W.

Pelecanus spectabilis . N. S. W., V. D. L., and I. in B. S.

Sula Australis *Gould.* N. S. W., V. D. L., and I. in B. S.

Spheniscus minor . Rivers of V. D. L., and seas of B. S.

Lestris catarrhactes ? . V. D. L.

—— leucomelas . N. S. W., V. D. L., and I. in B. S.

Xema Jamesonii *Wilson.* V. D. L.

Sterna poliocerca *Gould.* Seas of N. S. W., V. D. L., and B. S.

—— velox *Gould.* Seas of N. S. W., V. D. L. and B. S.

Sternella Nereis *Gould.* Seas of N. S. W., V. D. L., and B. S.

Hydrochelidon fluviatilis . Seas of N. S. W., V. D. L., and B. S.

Diomedea exulans *Linn.* Seas of N. S. W., V. D. L., and B. S.

—— cauta *Gould.* Seas of N. S. W., V. D. L., and B. S.

—— melanophrys *Temm.* Seas of N. S. W., V. D. L., and B. S.

—— chlororhyncha *Lath.* Seas of N. S. W., V. D. L., and B. S.

—— fuliginosa . Seas of N. S. W., V. D. L., and B. S.

Daption Capensis *Steph.* Seas of N. S. W., V. D. L., and B. S.

Procellaria gigantea *Gmel.* Seas of N. S.W., V.D.L., and B. S.

———— leucocephala . Seas of N. S. W., V. D. L., and B. S.

———— Solandri *Gould.* Seas of N. S. W., V. D. L., and B. S.

———— cœrulea . Seas of N. S.W., V. D. L., and B. S.

Prion Ariel . Seas of N. S. W., V. D. L., and B. S.

Puffinus brevicaudus *Gould.* Seas of N. S. W., V. D. L., and B. S.

Thalassidroma Wilsoni . Seas of N. S. W., V. D. L., and B. S.

———— Nereis *Gould.* Seas of N. S.W., V. D. L., and B. S.

REPTILIA AND AMPHIBIA.

To the original 9 species of reptiles which had been described in Captain King's Appendix, 107 have been added since. Of these, 4 species belong to *Monitoridæ*, 31 species to *Scericidæ*, 2 to *Gymnopthalmidæ*, 1 to *Liatisidæ*, 2 to *Pygopidæ*, 3 to *Rhodonidæ*, 1 to *Aprasiadæ*, 8 to *Geckotidæ*, 9 to *Agamidæ*, 1 to *Chamæleonidæ*, 1 to *Viperidæ*, 15 to *Colubridæ*, 1 to *Boidæ*, 3 to *Hydridæ*, 4 to *Chelydæ*, 3 to *Chelonidæ*, 1 to *Crocodilidæ*, 4 to *Ranidæ*, 11 to *Hylidæ*, and 2 species to *Bufonidæ*.

The determination of the above 107 species is due to J. E. Gray, Esq., of the British Museum; and the catalogue which he gave of them is to be found in the *Tasmanian Journal of Natural Science, &c.*, Vol. I. No. V. 1841.

ANNULOSA.

The published discoveries of Australian insects subsequent to these of Wm. Sharp M'Leay, Esq., inserted in Captain P. P. King's Appendix, are as yet very limited. Our knowledge, however, of that interesting branch of natural history cannot fail to be extended soon, by the illustrious entymologist residing now in Sydney, and to whom science is already indebted for the most valuable contributions.

PISCES.—RADIARIA.—MOLLUSCA.

For the additions made to the class of fishes we are indebted to T. I. Lemprière, Esq., Deputy Assistant Commissary General in Port Arthur, Van Diemen's Land, who collected the specimens, and to Dr. Richardson, of the Royal Naval Hospital at Haslar, who determined them.

The interesting description which Dr. Richardson gave of these specimens, inserted partly in the *Zoological Transactions* of 1839, partly in those of 1841, embraces 35 species; to which, if we add the contributions made by the French, and those previously secured by Captain P. P. King, R. N., the known number of species of Australian fishes up to the present day will not exceed 60!

The classes of *Radiaria* and *Mollusca* cannot even boast of so many; surprising deficiency indeed, when the abundance of the marine fauna in New South Wales and Van Diemen's Land, and the extent of the British navigation between those parts and England, is borne in mind.

With a view of facilitating the transmission of specimens of natural history in good preservation from the colonies to England, Dr. Richardson communicated to the Tasmanian Society an excellent paper, in which cheap means are devised towards attaining the desirable object. That paper is inserted in the *Transactions* of that useful and highly important society.—*Tasmanian Journal*, Vol. II. No. VI.

In the above review of the state of Recent Fauna of N. S. W. and V. D. L., we see, that if some classes — as reptiles, fishes, insects, marine shells, and zoophytes — show as yet great deficiency in the number of the species known, and lay strong claims to the attention of naturalists, our knowledge respecting the *Mammalia* and *Aves* is nearly complete, — a result the more gratifying as being entirely due to the efforts of private enterprise.

To enter on the description of the species which that knowledge of quadrupeds and birds embraces,—to assign to each species its proper geographical region,—to give, farther, an idea of their habits, forms, and the gaudy colours with which many of them are clothed, and which no pen can adequately do, — would be an attempt as difficult as inconsistent with the general plan and the limits prescribed to this volume. Nor would an attempt to epitomise, or describe by a few partial gleanings, those treasures of anatomical knowledge connected with the physiological condition of the *Marsupials* and *Ornithorhynchus*, with which Owen has so richly endowed the science, be any thing better than trifling with a subject which is deserving of, and which has received, the most minute and serious investigation.

The reader, then, must be referred, for the physiological description of the Australian zoology, to the papers of that eminent naturalist, Owen; some of which are inserted in the *Philosophical Transactions*, London, 1832, Part II., and 1834, Part II.; some in the *Zoological Transactions* of 1835, Part III.; while others, relating to the *Marsupialia* and *Monotremata*, form most important articles in the *Cyclopædia of Anatomy and Physiology*. (1841 and 1842.)

For a description and illustration of the *Mammalia* and *Aves*, and which, in the most settled parts of the colonies are threatened with extinction, we may refer the inquiring reader to the splendid works of Mr. J. Gould, F. R. S., with the certainty of his not being disappointed by its perusal. At the time when the writer of this volume was exploring the two colonies, Mr. Gould was on a zoological tour in New South Wales and Van Diemen's Land; and from the circumstance of his studying the quadrupeds and birds before collecting them, and of his losing no time, after they became specimens, in transferring and fixing on paper by a masterly drawing, their shape, colour, posture, and the plants upon which they fed, his work acquires a value and authority to which few others of this description can pretend.*

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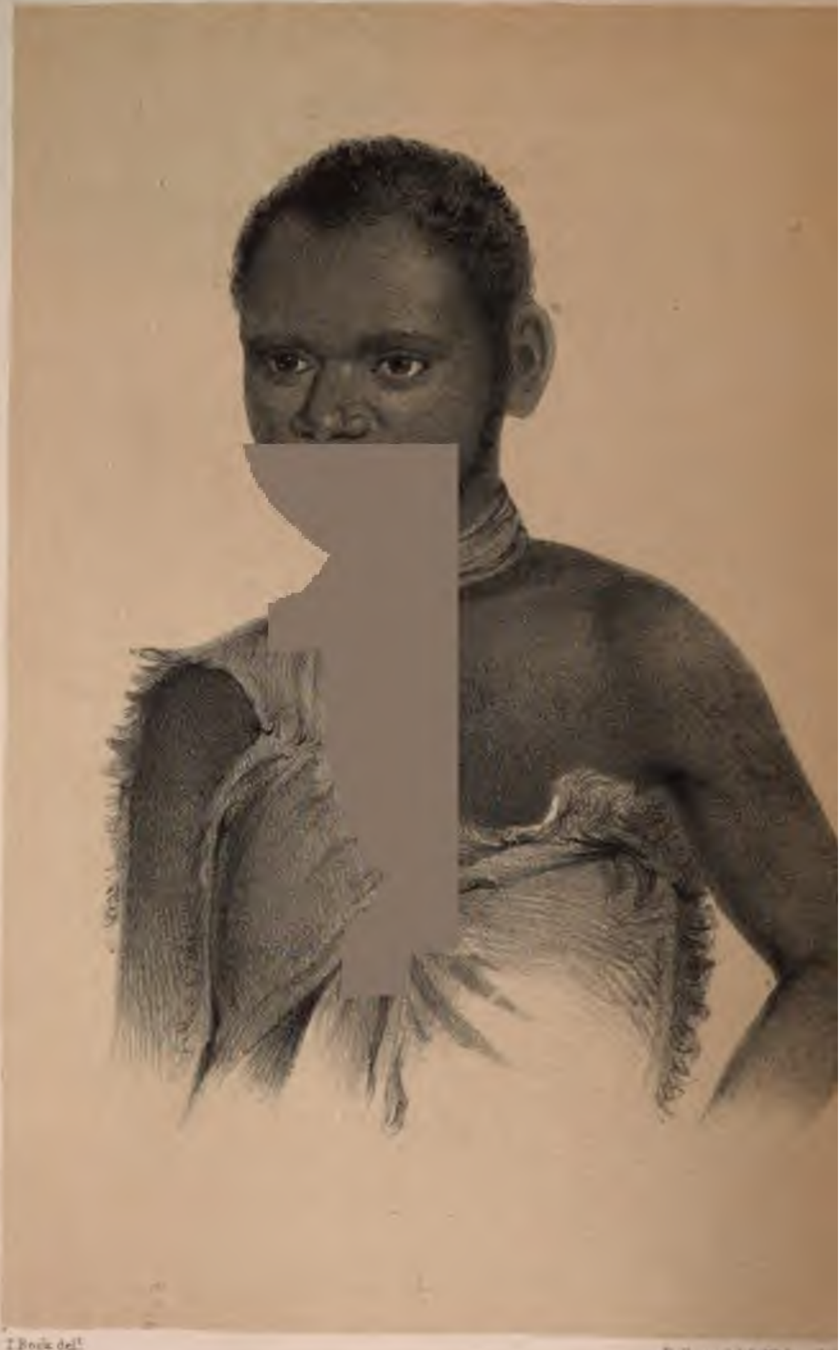
* "In the year 1838, Charles Lucian Bonaparte, Prince of Musignano, mentions, in his '*Comparative List of the Birds of Europe and America.*' that 'Mr. Gould's work on *The Birds of Europe* is the most beautiful work on Ornithology that has ever appeared in this (England) or any other country.' And such it undoubtedly was, at the time the Prince was writing; but the work of which we are going to speak, and of which two parts have already appeared, is likely, if we may judge of the whole by this sample, to prove as superior to *The Birds of Europe* as that work was to the *Century of Himalayan Birds*, of the same author. The *Birds of Australia* is, in fact, a princely work; and in no other country but our father-land could such an *ouvrage de luxe* be brought out without the patronage and support of the government; and we have only to look at the Continental works on ornithology, to see how immensely inferior the best of them are to those of Lear, Swainson, and Gould. Temminck's plates are certainly beautifully coloured; and the subjects selected by Le Vaillant are some of the most gorgeous in nature, but they are all evidently portraits taken from stuffed specimens in museums; whereas those of Swainson and Gould bear evidence of having been taken from those living beings, the most graceful of all God's creatures, each species of which possesses a movement peculiar to itself, sufficient to distinguish it from all its congeners.

"Australia may well be proud that, though the last of the great geographical divisions discovered, she will be the second to have her feathered race illustrated; for, with the exception of Europe, she will stand alone." — *Tasmanian Journal of Natural Science, &c.* No. II. 1841.



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JEMMY.

Native of the Hampshire Hills,

VAN DIEMEN'S LAND.

SECTION VII.

ON THE ABORIGINES OF NEW SOUTH WALES AND VAN DIEMEN'S LAND.

In that part of Australasia referred to in the preceding pages, there once existed, and, in a few instances, there still exists, an indigenous race, which, like the rest of the animal creation belonging to and characteristic of the zone, lived long unknown, and is now rapidly passing away.

Their history has no records, no monuments; but consists mostly of traditions, which, in common with their language, customs, moral, social, and political condition, seem ever since their discovery, to have been regarded as a subject unworthy of European study. Hence, all the observations contained in the narratives, whether of the early navigators, or of modern travellers, bear more upon what this race is in relation to the colonist than in [illegible].

Their origin, like that of most things in question, is involved in impenetrable obscurity; and such persons as have attempted to trace their migrations, or to point out the links which connect them with any of the predominant and primitive races of mankind, have not succeeded more satisfactorily than a naturalist would, who might attempt to account for the existence of the *Marsupials* and the *Ornithorhy* in Terra Australis; thus affording another arg that, on such subjects as the origin of a hum we must be satisfied with the simple dog Scripture.

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Their origin, like that of most things in creation, is involved in impenetrable obscurity; and such authors as have attempted to trace their migrations, or to detect the links which connect them with any of the predominant and primitive races of mankind, have not succeeded more satisfactorily than a naturalist would, who might attempt to account for the existence of the *Marsupials* and the *Ornithorhynchus* in Terra Australis; thus affording another argument, that, on such subjects as the origin of a human race, we must be satisfied with the simple declaration of Scripture.

Throughout New South Wales and Van Diemen's Land, the external organisation of the aborigines bears the stamp of different families; with, again, such variations as the nature of the climate, combined with other conditions of life, would naturally impress upon the human frame.

Thus, in New South Wales, where the heat promotes perspiration, and renders bathing a luxury, the hair of the natives is fine and glossy, the skin of an uniform colour, smooth and agreeable to the touch; whereas in Van Diemen's Land, which is cold, wet, and liable to sudden changes of temperature, where bathing ceases to be a pleasure, and the body is subject to checked perspiration, the skin appears scaly, spotted by cutaneous disease, and weather-beaten; and the hair, a prey to filthiness, is subject to still more filthy customs, in order to avert its consequences.*

Generally speaking, the colour of all the races is an earthy black: the stature of the male ranges between 4½ and 5½ feet: the head is small; the trunk slender; the breast is commonly arched and well developed; the arms and legs of a rounded and muscular form; the knee rather large, the calf small; the foot flat, and the heel somewhat protruding. The hair is generally black, rough, lank, and coarse: with some, however, it is soft and curling; while with others, again, it is of a woolly texture, similar to that of the Africans. On the eyebrows it is thick; on the chin, the upper lip, the breast, the pubes, and the scalp, it is bushy; in some instances it slightly covers the whole body.

The face, that characteristic feature of the race, presents a facial angle of between 75° and 85°. It is marked by a low forehead, eyes large, far apart, and half covered by the upper lid, with a conjunctiva of the purest white, spotted with yellow; the iris invariably a dark brown, the pupil large and of a jet black; a nose broad and flat, the frontal sinuses being remarkably prominent, the nostrils extending and wide-spread; cheeks generally hollow, with prominent malar bones; a wide mouth, with large white teeth, and thick lips; the lower jaw unusually short, and widely expanded anteriorily.

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* I allude to the anointing of the head with a mixture of clay, red ochre, and fish grease, in order to prevent the generation of vermin.

The stature of the women is low, the head short, and the features masculine: the mammæ, instead of being hemispherical, are, in marriageable persons, pyriform, and soon after marriage become flaccid and elongated. The arms are slender; the hands small; the pelvis unusually narrow; the lower extremities slight, strait and lean; the foot large, flat, and invariably turned inward.

The osteology of this race does not offer any anatomical distinction which can be looked upon as characteristic; and though it has been said that in some of their skulls the structure of the individual bones of the face and cranium discloses a peculiarity, closer examination and comparison have shown that, instead of peculiarities, strong analogies were found to the skulls of white men: in many instances, it was even remarked that the facial angle of the white was more acute, the superciliary ridge, the centres of ossification of the frontal bone, and the ridge of the occipital one were more developed, and the inferior maxillary more widely expanded than in the skulls of the aborigines.

Yet, notwithstanding a partial inferiority of shape in some of the details, the native of New South Wales and Van Diemen's Land possesses, on the whole, a well-proportioned frame. His limbs, less fleshy or massive than those of a well-formed African, exhibit all the symmetry and peculiarly well-defined muscular developement and well-knit articulations and roundness which characterise the negro: hence, compared with the latter, he is swifter in his movements, and in his gait more graceful. His agility, adroitness, and flexibility, when running, climbing, or stalking his prey, are more fully displayed; and when beheld in the posture of striking, or throwing his spear, his attitude leaves nothing to be desired in point of manly grace. In his physical appearance, nevertheless, he does not exhibit any features by which his race could be classed or identified with any of the generally known families of mankind.

The speech of this people possesses, in the composition of its words, all those felicitous combinations of syllables which constitute a highly sonorous and euphonious language. Their enunciation of words, however, is not clear, being somewhat marked by that "twang" which is heard also in all the European languages when transplanted to the New Worlds.* From a partial knowledge of it, I should be rather disposed to class the Australian language (*i. e.*, that of New South Wales and Van Diemen's Land,) among those called Transpositive, — those which are independent of articles and pronouns, the case and person being determined by the difference in the inflexion.

The study, however, of this language has been so little regarded, that any opinion respecting its syntax must be received with extreme caution.†

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* It is to be regretted that, through neglect or some other cause, the purity of the pronunciation of English, Spanish, and Portuguese, when spoken out of the Old Word, has suffered greatly. Thus, the oppressive nasal drawl, which renders the pronunciation of the English language in the United States a constant theme of vulgar jocularity, is equally observable in the English spoken in South America, New Holland, and Van Diemen's Land, as well as in China and the East.

† Amongst the researches relative to the Polynesian tribes, none deserve greater credit than that through which the American missionaries in the Sandwich Islands succeeded in reducing the oral language of those islands to a regular syntax. — *Vide Hawaian Spectator.*

Its dictionary, so far as it has been compiled, is scanty; and owing to the English mode of spelling the words, this dictionary, or, more properly speaking, vocabulary, is very far indeed from giving a just idea of the sound or accentuation.

The circumstance of the three natives who accompanied Captain Flinders and Captain P. P. King in the survey of New Holland, and of those who accompanied me amongst the different tribes of New South Wales, being unable to understand one word spoken by tribes of other districts, would lead to the belief that the dialects spoken in New Holland are far from possessing those affinities, still less those identities of language, from which a common root might be inferred.

Those European visitors or explorers who adduce, in support of a common root, some hundred words analogous in sound, construction, and meaning, as being spoken all over New Holland, have jumped to the conclusion with, I fear, too much haste and eagerness. Besides many other insuperable difficulties, which an investigation of such a nature presents, there was one quite sufficient to defeat all attempts to fathom the subject, namely, the syntactic ignorance of the language to which the inquiry related. Indeed, to any man who knows and speaks four European languages, it will be at once apparent, that to seize upon, and note from the sound, a word belonging to one country, so as to compare its sound and accentuation with a word belonging to another country, needs a thorough knowledge of the genius of the *two* languages, and of their alphabet, through which alone the pronunciation can be discriminated. Thus, only those who know syntactically the Polish language, can express the sound of *szczaẃ* (sorrel), and seize upon the Russian word signifying and sounding the same, in order to prove the identity of the two words: thus again, for a Pole unacquainted with the English and Spanish, it would be impossible to record the sound of *th*, in order to find its equivalent in the *c* or *z*, as pronounced in *Andaluz*.*

The limited state of our knowledge respecting the language of Australasia presents also a barrier to inquiry into the force, activity, tendency, and advancement of the mental faculties of its natives.† The incidents which are accessible to observation, would lead to the belief, that of the faculties alluded to, an instinctive good sense, accompanied by quick perception, and a retentive memory, here and there blended with the errors or excesses of an ardent imagination, is all that is thoroughly developed in the mental endowment of that race, and serves as its sole guide through life.

The nature of the religion and government of the

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* In the different accounts of the South Sea Islands, it is not uncommon to find the language of those islands denominated by the general term of "Polynesian language." According to my experience, the language of the Marquesan group has no more affinity with that of the Gambier or Friendly Isles, than the latter have with that spoken in the Sandwich Islands. The assumption of a Malay language, as spoken throughout the Malay islands, is not less absurd; as Java, Lumbock (with 1,000,000 inhabitants), and Bailly also (with 300,000), possess four spoken idioms. To explain each to me, three different interpreters were hardly sufficient. Beyond these islands, again, the Cyclops, Temos, and Sandal-wood islands, differ materially, not only as regards language, but also manners and religion.

† Hitherto physical geography, in describing "man," has classified him according to the characteristics which his external organisation presents. Philosophers, in the contemplation of his destiny, rejecting that classification, have viewed him merely as a member of the whole human race; but the day is, perhaps, not far distant, when both philosophers and naturalists will admit that it is the instinctive and mental faculties peculiar to each race, and in perfect accordance with the local circumstances in which that race is placed, which constitute the true principles of that classification. The study of this instinct, which may be looked upon as a guide to the politics and morality of every race, has been lost sight of; and this is the fruitful source of all the errors and failures of political and religious regenerators, who labour, in opposition to the history of past and modern ages, to reduce all the races of mankind to one uniform standard of customs and institutions.

Australian natives is as mysterious as the genius of their language. One fact appears certain—they recognise a God, though they never name him in their vernacular language, but call him, in English, "Great Master," and consider themselves his slaves. Hence perhaps, it is, that neither the gift and privilege of life, nor the means provided to maintain it, excite in them the least feeling of obligation or gratitude. All those things which are pointed out to them as the free gifts of Providence, and therefore as deserving of acknowledgment, they consider that it is no more than the duty of the "Great Master" to supply them with. They believe in an immortality, or after-existence, of everlasting enjoyment; and place its locality in the stars, or other constellations of which they have a perfect knowledge. They do not dread the Deity; all their fears are reserved for the evil spirit, who counteracts the doings of the "Great Master;" and consequently it is to the evil spirit that their religious worship is directed.

There are three distinct classes, or social gradations observed amongst them. These are attained through age and fidelity to the tribe; but it is only the last, or third class, consisting commonly of the aged few, which is initiated into the details of the religious mysteries, and which possesses the occult power of regulating the affairs of the tribe. Great secrecy is usually maintained in the ceremonies of admitting the youth to the first class, and in raising those of the first to the second; but the secrecy is most rigidly observed whenever an initiation into the third class takes place.

One or two tribes usually attend the meetings of the first or second class; but when those of the third are called, the tribes within seventy miles assemble; and on these occasions I was warned off, and could not, without personal danger, approach nearer than ten miles to the spot.

The foundation of their social edifice may, like that of civilised nations, be said to rest on an inherent sense of the rights of property. As strongly attached to that property, and to the rights which it involves, as any European political body, the tribes of Australia resort to precisely similar measures for protecting it, and seek redress and revenge for its violated laws through the same means as an European nation would, if similarly situated. Thus, if his territory has been trespassed upon, in hunting, by a neighbouring tribe, compensation or a reparation of the insult is asked for. If such be refused, war ensues; and when both tribes display equal force and courage, in most cases ends in a feud which is bequeathed to future generations.

Every tribe is subdivided into families, and each, in its family affairs, is regulated by the authority of the elders. The customs and ceremonies observed on the occasion of births, marriages, sickness, funerals, and festive meetings are independent of that authority: they are traditionary, and, particularly in point of etiquette, are as rigorously adhered to as amongst civilized nations. A great many of the superstitious practices connected with the rights of hospitality* are closely allied to those which the writer noticed in the prairies of North America, amongst the Indians of South America, and in some of the South Sea islands.

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* "From the rugged and broken crest of the mountain, we at length beheld at our feet, in the shade of a thicket, the long-looked-for pond of water, walled round as it were by the smoking wigwams of an encamped tribe. Impatience, almost amounting to frenzy, to relieve the thirst which had consumed us for days, took possession of me: my strength and spirits rallied, and I rushed headlong towards the longed-for spot. 'Stop, for Heaven's sake,' cried my native guide; 'stop, or we are lost.' Seized and retained by him, I stopped short: we altered our course, speedily gained the foot of the hill, and, instead of entering the circle of the wigwams, squatted ourselves down at about sixty yards from them. A quarter of an hour had already passed away: already angry impatience, and the pangs of hunger and thirst, were about to burst asunder all the restraints of reason, when a piece of burning wood was thrown

This identity or analogy seems to prove, that either the social age, which the Australians have attained in the course of human progress, is the same as that of the nations alluded to, or that these similar customs and superstitions have resulted from similar interests, passions, propensities, or exigences.

Their superstitious spirit watches eagerly the coming and passing of every event, and not less eagerly seeks to draw, from the present, intimations of the future. The mysterious belief in good or evil omen, links the present and future of the Australian in one unbroken chain of anxieties, fears, hopes, and anticipations. His life, then, like that of the Arabs, possesses, amidst the monotony of existence, elements of excitement in infinite variety, both painful and pleasurable.

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towards us from the nearest wigwam. My guide then rose, and proceeded to pick it up with a measured step; returned, kindled a fire, put on it an opossum, which we had in store; resumed his position, continuing to gnaw his stick, and at times stirring the fire, at times casting his looks sideways. In ten minutes more a calabash of water was brought by an elderly woman, and left midway between their fire and ours. The calabash was followed by fish, laid on a neat strip of bark, which, like the piece of burning wood, was brought to our hearth by the guide. Hunger and thirst were soon appeased, and extreme fatigue had just begun to close my eyes, when an old man in the camp rose up and advanced towards us. The guide met him half-way, and a parley ensued, in which the object of my wanderings was inquired into, and ascertained. On the return of the old man, a thrilling and piercing voice was heard relating the subject to the meeting. Silence followed for a few moments, when, instead of the expected invitation to join the camp, we were ordered to return from whence we came. There was no appeal against this decision. We rose and began to retrace our steps. Simple child of nature! faithful to her inspirations, the native of Australia proceeds in the discharge of hospitality by a way exactly the reverse of our own: he first satisfies the wants of a traveller, and afterwards asks him those questions which in our civilisation precede and regulate the kind and quantity of the hospitality to be accorded, and sometimes prompt its refusal altogether." — *MS. Journal of the Author.*

His poetry evinces the same activity and exuberance of imagination as his superstition: it is lyrical, wild, and primitive; but love, that most beautiful object and element of all poetry, is excluded from it. Mysticism, and sometimes valour in combat, but more frequently licentiousness and the praise of sensual gratification, are his favourite themes. This poetry is never recited: it is sung; and, when once composed, passes through all the tribes that speak the same language with surprising rapidity.

Migration, the chase, fishing, and occasional war, alternated by feasting, and lounging in the spots best adapted to repose, fill up the time of an Australian. The pangs and gnawings of ambition, avarice, discontent, or weariness of life, the distress caused by oppression or persecution, the maladies arising from the corrupt or artificial state of society, are unknown to him; as are also the cares and anxieties of arts, sciences, and industry; from all of which, the physical condition of the country, and the manifold provisions of a beneficent Providence have preserved him; whilst that share of health and content which falls to his lot, rewards him amply for his faithful adherence to the dictates of nature.

Few spectacles can be more gratifying to the philosopher than to behold him and his in their own as yet uninvaded haunts; and few can exhibit a more striking proof of the bountiful dispensation of the Creator, than the existence of one whose destiny the singular presumption of the whites, in their attachment to conventional customs and worldly riches, has stigmatised and denounced as "savage, debased, unfortunate, miserable." To any one, however, who shakes off the trammels of a conventional, local, and therefore narrow mode of thinking,—to any one who studies and surveys mankind in personal travels, and by personal observation,—it will appear evident that Providence has left as many roads to the threshold of contentment and happiness as there are races of mankind; and when he beholds the serene, calm, mild, yet lively countenances of the Australasian natives, — their dance and song, those uncontrollable manifestations of attained felicity,—he finds really in the scene a corroboration of what otherwise a mere inference, from the goodness and omniscience of the Creator, might have taught him to believe.

Placed by that Creator, in perfect harmony with the whole economy of nature, in his allotted dwelling and destiny, the Australian is seen procuring for himself all that he wants, regulating all his social affairs, and securing all the worldly happiness and enjoyment of which his condition is capable.

The arrival of Europeans disturbed this happy economy; and the hearths of the natives, like the wigwams of the American Indians, retreated or disappeared before the torrent of immigration.

The manifold calamities*, — but more particularly

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* The slave trade, that stigma which the sordid thirst of gain has fixed on European civilisation, is not one of the least frightful of those evils which result from our intercourse with indigenous tribes. England has nobly avenged the cause of outraged humanity, by placing herself at the head of that most noble of crusades engaged in the abolition of this infamous traffic. Ignorance of the evils which this traffic entails can alone have been able to calumniate a christian policy, and to represent it as a series of tortuous and unworthy intrigues, of which the ruin of Brazil and of the Antilles, and the further aggrandisement of the East Indies, were to be the only result.

Let those who in the abstract principle of slavery see nothing disgraceful to the legislation of our age, reflect on the individual misery it produces, and the feelings of horror they must then experience will suffice to refute all the arguments of a false and worn-out logic.

To those innumerable pictures of suffering which the slave trade has furnished, and which have so often been exhibited to the public, I will add the following, of which I was myself an eye-witness. I find it inserted in my journal of 1836.

Rio Janeiro, 22nd January, 1836.—Yesterday, Her Britannic Majesty's sloop of war, the "Satellite," Captain Smart, brought into this the decrease and final annihilation of the great majority of indigenous races which has followed, and always does follow, the approach of the whites, — is a fact of such historical notoriety, that the melancholy instance

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port a brig engaged in the slave trade, which she captured not far from the coast.

I have been to-day to look at this slaver, and, fully prepared as I was for the spectacle, which is daily becoming more rare, I own that the picture of human wretchedness which my imagination had painted was far surpassed by the reality. No sooner had I looked over the ship's bulwarks, than I felt as if the chain which attached me to civilisation had broken. I should most certainly have retraced my steps, had not the British Consul, Mr. Hasketh, who was behind upon the ladder, pushed me forwards.

In a brig of 150 tons, and between decks not more than 3 feet apart, 300 slaves, of both sexes, were squeezed closely together; so closely, that the space between the legs of one was occupied by the body of another. Bathed in perspiration, wallowing in ordure, — their own breath, mingling with the most mephitic of exalations, formed their only atmosphere! The frightful thirst which consumed them was only farther irritated by the ten ounces of water which formed their daily allowance! The tropical sun heated also with its beams the upper deck, which pressed upon their heads. The frenzy produced by such a state of suffering had carried away a fifth of their number; and the wretched creatures who survived — great God! what a sight! Men, women, and children huddled together in every possible posture, and expressing their mingled feelings of joy, astonishment, hope, fear, respect, curiosity, and anguish, by strange convulsive movements; their naked, attenuated bodies, covered with sores, telling the history of their wrongs and sufferings, and exposing more eloquently than could their tongues the ferocity of the slave-trader. The marks of the *chicote* (a kind of knout) upon the back too clearly identified the instrument, which lay before us, which this Christian of the nineteenth century used according to the dictates of his caprice. Among these victims of the avarice and barbarity of Europeans — greater cannibals than those who bear the name, were pregnant women, several of whom gave birth to infants in this situation, in the midst of men, and under all these privations and tortures!

Since the capture of the brig, every means had been taken to purify it, and to cleanse the Africans. All the cares and methods which humanity could devise had been resorted to, and yet the atmosphere of the vessel, at a temperature of 96°, was of such a quality as rendered it impossible for me to remain in it longer than fifteen minutes. While I did remain, two men breathed their last sigh beside me, and one woman, just ready to follow them, gave birth to an infant! . . . . . My pen falls from my hand, and I hide my face in shame and humiliation, at the thoughts of the calamities which the crimes of my fellow-men produce. —*MS. Journal of the Author.*

of the Australian natives affords but a farther corroboration of the fearfully destructive influence which the one race exercises upon the other.

Those in whose eyes the question of decrease and extinction has assumed all the mournful solemnity and interest which it merits, have inquired into the nature of that invisible but desolating influence, which, like a malignant ally of the white man, carries destruction wherever he advances; and the inquiry, like an inquest of the one race upon the corpse of the other, has ended, for the most part, with the verdict of, "Died by the visitation of God."

Some authors, indeed, animated by the idea that the detection of a specific cause, more within the reach of human power, might lead to the discovery of a remedy, still pursued their laudable investigations; and believing the decrease to be owing to the want of evangelical instruction, to oppressive governments, to intemperance, to European diseases, to wars with fire-arms, &c., have sought a remedy in attempts to Christianise, and to introduce civilisation; but such attempts have appeared to increase, rather than diminish, the evils complained of.

To the writer of this work, who, in his peregrinations out of Europe, has lived much amongst different races of aborigines,—the natives of Canada, of the United States, of California, Mexico, the South American republics, the Marquesas, Sandwich and Society Islands, and, finally, those of New Zealand and Australia, have furnished observations of a different tendency, which are here submitted to the reader, *not as evidences for the deduction of an ultimate conclusion*, but as mere facts, fitted to lead physiologists to further inquiry into this grave and interesting subject; an inquiry more within their sphere than within that of a moralist or economist.

The fact being generally admitted, that the decrease of the aborigines, in the countries enumerated, has always begun soon after their discovery and subjection to foreign influence; the next question must be, whether this arises from the increased rate of mortality, or from the decrease of births.

Examinations among the oldest aborigines of every country — as, for instance, among those who remember the first American war in the United States, the government of the Jesuits in Brazil, St. Borje,— Paranna, and Lower California,—the arrival of Cook and the early navigators in the South Sea Islands, New Zealand, New South Wales, and Van Diemen's Land, — render it evident *that their longevity has not been abridged, that the rate of mortality has not increased, but that the power of continuing or procreating the species appears to have been curtailed.*

On further inquiry, this curtailment of power was not found to originate with the male, at least so far as could be observed; but some startling facts, disclosed in the course of the investigation, seem to confine it to the female alone.

Of these, the most remarkable, and that which most directly bears upon the question, is the result of a union between an aboriginal female and an European male, — an intercourse frequently brought about in these countries, either by local customs and notions of hospitality*, or by the natural propensity of the sexes. Whenever this takes place, the native female is found to lose the power of conception on a renewal of intercourse with the male of her own race, retaining only that of procreating with the white men.

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* Xalisco (Mexico), 23rd of April, 1837. — When I said that the country which I admired from the heights of Santa Cruz de Tepic is without historical associations or traditions, I committed a flagrant error. Xalisco possesses the tombs of ancient Indians, where several relics, such as arms, urns, and female ornaments, have been recently discovered. The city has also archives, and a voluminous manuscript relating to the conquest of the province by the Spaniards. I subjoin some brief extracts from this curious chronicle, compiled in 1642, by the licentiate Doctor Don Matthias de la Mota Padilla, who wrote to "satisfy the wishes of the kings of Spain, by transmitting to posterity the memory of the glorious deeds achieved by their vessels; to satisfy my own (the Doctor's) conscience, by describing to the entire world the

Hundreds of instances of this extraordinary fact are on record in the writer's memoranda, all tending to prove that the sterility of the female being relative only to one, and not to another male,—and recurring invariably, under the same circumstances, amongst the Hurons, Seminoles, Red Indians, Yakies (Sinaloa), Mendoza Indians, Araucos, South Sea Islanders, and natives of New Zealand, New South Wales, and Van Diemen's Land,—is not accidental, but follows laws as cogent, though as mysterious, as the rest of those connected with generation.

To this direct, though occult, cause of the decrease of the aboriginal race, may be added others, which, though acting indirectly, far surpass the evil consequences of the first, as their agency is seen to extend still farther, so as to occasion absolute sterility in the native female. Of these, the leucorrhœa, a general complaint, raging with unusual severity and aggravated symptoms, affords a most extraordinary instance; not only because its character might be mistaken by many observers for secondary symptoms, or a modified elephantiasis, but because its origin

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progress of the Spaniards as conquerors, of the numerous converts for Holy Church,—in hopes that the enumeration of the conversions may henceforward serve as an argument to cover heretics with shame, and to confound their abominable doctrines."

As the author only proposes to treat of the province of Xalisco, he confines his general observations upon Mexico to what his subject strictly requires, and commences by a glowing description of the fête which the Queen of Xalisco gave to Fernando Cortez. The following extract describes the nature of the hospitality to which this note refers:—

"Hospedado Don Francisco Cortez en su alojamiento le pareció á la Reyna, obsequiarle con varios regalos; y viendo que en el exercito de los Espagnoles no habia mugeres, le remitió ciento."

amongst the native women dates precisely from the arrival of the European females amongst them.

Be the cause of the decrease and extinction of the aborigines in the New World what it may, it is certain that human interference to avert its melancholy consequence has been hitherto of no avail, and that a charter for colonisation granted to one race, becomes virtually the decree for the extinction of the other.

Thus, in New South Wales, since the time that the fate of the Australasian awoke the sympathies of the public*, neither the efforts of the missionary, nor the

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* Since the time that the aborigines have been declared by law, or rather, sophistry of law, to be illegitimate possessors of any land which they do not cultivate, the Australian has been looked upon, *ipso facto*, as a sort of brute intruder! and in the transactions which ended in the taking possession of New Holland by England, has been allowed no more voice than the kangaroos.

In the course, however, of colonisation, some humane observers made the discovery that he was somewhat superior to the brute creation, and lifted up their voice in his favour with such effect, that the public of the mother country, passing from extreme apathy to unbounded tenderness and solicitude, invited him at once to take his share in the benefits of Christianity and civilisation. The share, however, which came to his lot, proved to be very much like that which issued from "Ego Leo," — as the Christianity which was offered to him was stripped of its charity, and the civilisation embraced no recognition of his rights of property. He therefore rejected both; took to the "bush," and, pressed by hunger, fell upon the flocks which invaded his hunting-grounds, and by stealth or open force carried them away. Between those in charge of the flocks and himself fatal conflicts ensued. The public clamours against these outrages at last reached England. Those only committed against the aborigines, in absence of all the circumstances which provoked retaliation, were considered; whereupon a new society started, under the auspices of pure philanthropy, to supply the inefficiency of missions. The "protectors" who were sent out by this association to espouse the cause of the aborigines, only complicated the affair. Their arrival among the now turbulent, excited, and revengeful natives, instead of appeasing, emboldened them to such a degree, that, at the time I am writing (Port Stephen, New South Wales, January, 1843), their depredations have already opened another field of exertion for a new association, an ASSOCIATION FOR THE PROTECTION OF THE WHITES.

Although, in the writer's opinion, the natives of the New World have, wherever the European advances, the sentence of extinction stamped indelibly upon their foreheads, still it is his conviction that this doom of aborigines in general, and of the Australians in particular, enactments of the Government, and still less the protectorate of the "Protectors," have effected any good.

might have been retarded and rendered less painful, had the Government taken the initiative in attempting their re-organisation and reform, instead of leaving them to private associations. The question of the management of the Australian native was not purely a religious or philanthropic question; it was also a political one, and ought to have been decided solely by the Government *à principio*.

To have proclaimed him conquered, which he understands, and which would have enlightened him as to his position relative to the whites, which he is now rather puzzled to define; to have preserved and encouraged the compact of the tribes, which possessed within itself all the elements requisite to the regulation of their internal relations; to have declared him *"not of age"* in all his remaining relations with the whites, until the characteristic instincts of his race could have been conquered by Christianity and civilisation; to have provided in part for his maintenance, by furnishing him with rations of bread and meat, simultaneously served out on a particular day of the week;—such is the treatment which would have satisfied all the exigences of his political and physical life, and would have opened an easy field for missionaries to do their part in the great work, and would also have prevented those sanguinary conflicts which an unwise policy alone provoked.

As it was, the holy doctrine which the missionaries preached to the aborigines sapped the foundations of their normal government, and its dissolution followed. The voice of Christianity, of disinterested, spiritual religious faith, was rendered ineffectual by civil disorganisation. Those intrusted with its interests, their own safety threatened, saw themselves compelled to resort to power. In some instances, that power easily fell into their own hands, as in the Sandwich, Friendly, Society, and Gambier Islands; in others, it was resisted, as in New Zealand, New South Wales, and Van Diemen's Land: in either case, the endeavour to obtain it by the missionaries was stigmatised in Europe as an usurpation, worthy of the Jesuits of old;—a reproach as unjust as it was bitter; and which, whether applied to Jesuits or modern missionaries, would more properly attach to those at home who began the work of the regeneration of the natives at the wrong end; for since the first dawn of human history, the civil organisation of society has preceded its religious and moral instruction.

In New South Wales, under the influence of mere civil exigencies, the Colonial Government at length saw itself compelled to legislate for the aborigines of the country; but, tardy and confused, that legislation has only farther disorganised the old bonds which regulated their conduct. The late Act, declaring them naturalised as British subjects, has only rendered them legally amenable to the English criminal law, and added one more anomaly to all the other enactments affecting them. This naturalisation excludes them from sitting on a jury or appearing as witnesses, and entails a most confused form of judicial proceedings; all which, taken together, has made of the aborigines of Australia a nondescript caste, who, to use their own phraseology, are "neither black nor white."
— *MS. Journal of the Author.*

The attempts to civilise and christianise the aborigines, from which the preservation and elevation of their race was expected to result, *have utterly failed*, though it is consolatory, even while painful, to confess that *neither the one nor the other attempt has been carried into execution with the spirit which accords with its principles.* The whole eastern country, once thickly peopled, may now be said to be entirely abandoned to the whites, with the exception of some scattered families in one part, and of a few straggling individuals in another; and these, once so high-spirited, so jealous of their independence and liberty, now treated with contempt and ridicule even by the lowest of the Europeans,—degraded, subdued, confused, awkward, and distrustful,—ill concealing emotions of anger, scorn and revenge,—emaciated and covered with filthy rags,—these native lords of the soil, more like spectres of the past than living men, are dragging on a melancholy existence to a yet more melancholy doom.

In Van Diemen's Land, the drama of the destruction of the aborigines took another turn. In the course of colonisation, the outcasts of society, occupying the more advanced or interior stations in the country, and accustomed to treat with contempt any rights which their brutal strength could bear down, invaded the natives' hunting-grounds, seized on their women, and gave rise to that frightful system of bloody attacks and reprisals which provoked a general rise on the side of both whites and blacks, and ended finally in the capture and transportation of the latter, in 1835, to Flinders Island (Bass's Straits); a measure severe and sanguinary*, but necessary, and incumbent upon the Government, in order to put an end to those solitary murders which began to belie the existence of civilisation in the country.

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* "Buenos Ayres, August, 1836.—It was one of those delicious days of August, which, as some one hath said, 'fait aimer la vie,'—which, among fields, in the midst of solitude, on the bosom of friendship, tends only to inspire generous sentiments, soothing contemplations, and

grateful emotions, — one of those days in which the mind escapes from thoughts of the world, the tyranny and the revolutions of empires; but here, in Buenos Ayres, this vast sheepfold, where savage, bloodthirsty wolves are busied with incessant slaughter, the gifts of nature become so many fearful curses, and the loveliest day beams only on the deeds of the most barbarous of men.

"The scene I am about to describe was enacted in the square of the Retiro, which the Spanish Government had destined for a promenade and place of public amusement, but which Rosas, the present head of the republic, has made the spot for the carrying into execution of his sanguinary decrees. On the present occasion, it was not the blood of his fellow-citizens, but that of Indians, which he purposed shedding. The immense barracks which stand on one side of the square contained the victims of the day, who were brought out by tens at a time, and led to a corner formed by a wall which joined the barracks at right angles. There, seated in line on a wooden bench, they received the murderous volley; but alas! it was not the boon of instant death: the soldiers, though close at hand, aimed badly, — they mutilated, but did not kill: their fire was only a signal to the executioners, who cast themselves on the fallen victims, and after despatching them with knives, dragged their bleeding corpses in a cart to the distance of about twenty paces from the place of execution.

"The death of the first ten was a horrible announcement, to those who followed, of the fate in store for them. When the first victims were brought out, the grass was green and fresh as the day, the benches were clean, the executioners were not stained with blood; in fact, the first ten advanced and confronted death with a stoicism, a disdain, which must have filled the heart of the tyrant who immolated them with rage; but when the second, the third, the fourth, fifth, sixth, seventh, eighth, ninth, tenth, and eleventh (for there were 110 victims at this sacrifice!) advanced in turn, — when they saw the turf, the benches, and the executioners reeking with the blood of their brethren, — when the barbarity of these executioners exhibited those already massacred before the eyes of those who were to follow, the Indian, with such a spectacle before him, must indeed have shuddered, — and he did shudder, with all the force of shocked and convulsed nature. The few words that he articulated, with rapid and broken energy, were perhaps an invocation of the vengeance of his race upon the white man; perhaps, in the rage of despair, he rejected the God of the Christians from ever being his God!"

Such was the conduct in August, 1836, of the White towards the Indian. Let us see what was the conduct of the Indian towards the city of Buenos Ayres in 1806, when this city was in the hands of the English, — when the ignorance of the people at that period tolerated the recommending from the pulpit of a general insurrection, against men who were designated as "declared enemies of the Roman Catholic

At the epoch of their deportation, in 1835, the number of the natives amounted to 210! Visited by

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church and of peace,—as foes of the faith, of God, and of their fellow-beings." Let the document answer, which I have discovered in the archives of Buenos Ayres.

"NOBLE CONDUCT OF THE INDIANS.

"At the unfortunate juncture when this city (Buenos Ayres) fell into the hands of the English, the Indians, to the number of twenty-seven, were seen to quit it precipitately, in order to rejoin their own people. No sooner had they reached the camp than their brethren, informed of the tragical event, joined them in expressions of sincere regret on account of the loss we had sustained, and the lamentable consequences which the capture of the capital would have on their trade. As much for the sake of their own interests, as under the influence of the attachment they had for us, their warlike spirit became aroused in our favour. They called a meeting on the spot, proposed a general pacification of their various tribes, and departed in order to bring to amicable terms the Rongueles, Ancares, and Auracanos on one side, and the Pampas, Quehuelchuces, and Orices, on the other (tribes with whom they had been carrying on a war of extermination for the last three years), in order that by this peace they might—forgetting their own grievances—the better concert means for avenging King Charles IV., and for freeing his city from his red enemies, as they called the English.

"This friendly project, which is worthy of the highest praise, was crowned with complete success. The united Indians commenced their march, and presented themselves before us, to offer us 3000 of their bravest warriors, and 1000 horses, fresh and in the best condition.

"This warlike tribe was armed with the *tatera* (a species of casquet of triple leather), the *peto* (a leather shirt, doubled fourteen times, and which will turn a ball,) and with a lance eighteen feet long, large knives, poisoned arrows, and metal *bolas*. The tribe was commanded by the brave cacique Carraficlon, under whom the caciques Teralef, Millanau, Coranau, Curatipai, Kiatipi, Quidutef, Quintutepi, Coromil, Huachapan, Antenan, Raynam, Anteamea, Turanau, Nahuelpan, Okin, Lincon, Hurapuentu, Epumur, Baylahuan, Catrumilla, Huachecatamilla, Calfuquir, Calfuanti, the black cacique, and Luna, with several other captains and officers. The tribe offered us 12,000 men besides, if we should require them.

"To this generous proposal our illustrious municipality hastened to answer, that it deeply appreciated and acknowledged the act of friendship, but that, for the present, not requiring such aid, it begged them to return to the frontier, and to await there a new order. At the same time it recompensed the services of these savage people, who have been calumniously represented as our worst enemies, by liberally distributing among them those presents which best suited their tastes and wishes."—*Extract from "Semanaris de Agriculture, Industria y Comercia del Miercoles, 22 de Octubre de* 1806."

me in 1842, that is, after the interval of seven years, they mustered only fifty-four individuals! and while

Since this event, what crime have they committed, thus to draw down upon themselves the hatred and vengeance of the whites?

It is not in the annals of the Indians that such crimes will be found recorded. It is in those of the emigration of the Spaniards to the New World; it is in that cupidity, that insatiable avarice, which blots the pages of the history of almost all the civilised nations. The history of the settlement of Pennsylvania by William Pënn, and of that of South America by the Jesuits, are the only exceptions; serving as it were to present a contrast between all that is most lovely in human nature, and all that is most hideous.

Wherever the European has placed his foot in the New World, — wherever he has found an obstacle to his aggression in the rights of the native, he has always stigmatised him as *savage and irreclaimable, the enemy of Christ and of civilisation.* Here, as elsewhere, the first steps of the Spaniard are marked by painful memories. The influence of the Jesuits was favourable to the Indian; but the Jesuits were expelled, and the Spaniards renewed their bloody spoliations.

Then came the emancipation of the colonies, when agricultural industry, aided by foreign commerce, realised such large profits as to revive a thirst for territory among the white population. Not content with the vast conquests which Spain bequeathed him, conquests which she could never render profitable, nor people with her own race, the white continues advancing towards the south; the Indian, already driven from the banks of La Plata, is gathering again beyond the Rio Colorado, where he still disputes these encroachments, ever accompanied by murder and by the loss of his women and children, who are retained in captivity or sold as slaves. The reprisals, he often resorts to, know no bounds. Less dependent than his enemy on the common wants of life, able to subsist for many days without water, upon the dried flesh of horses, he watches and manœuvres incessantly, and never risks a pitched battle, — not as is said, because he lacks courage to do so, but because such a mode of fighting does not accord with his tactics, — a kind of horse guerilla, to which the vast solitudes of the plains are peculiarly adapted. Thus, at the approach of the hostile army, he vanishes from his camp with the rapidity of the eagle: suddenly and unexpectedly appears in the rear of the enemy, scours the pampas in every direction, cuts off the stragglers, waylays the travellers, attacks and plunders the farms, murders the labourers, ravishes the women; and then disappears again with the same rapidity, not because he is false and treacherous, as is pretended, but because the aim of his reprisals is accomplished.

It is then continual reprisals, provoked by continual aggressions, which constitute the unpardonable crime of the Indian in the eyes of the white man. The latter does not confine himself to reproaches. Unable to bring the enemy to a pitched battle, *he* also resorts to stratagem, and does not even hesitate to employ the basest treachery, in each family of the interior of New South Wales, uncontaminated by contact with the whites, swarms

order to entice the Indian into his snares. It was thus that in the month of April in the present year, 160 Indian chiefs were, under the guarantee of the most pacific assurances, enticed within the Fort del Souce, south of Cordova, Rio Quarto, and were there massacred in cold blood. It was thus also that the 110, who were assassinated in the Retiro, fell the victims of their credulity and misplaced confidence.

It is difficult to conceive, in this age of a civilisation in which the philanthropic opinion and spirit of legislation is on all sides labouring to avoid or to render less severe the infliction of punishment, that there are still every where to be met with, men who, with a wolf-like thirst for blood, command other monsters to execute deeds of useless murder, which these latter undertake and perform with the utmost *sang froid.* The further we examine into the history of this part of the world, the more we shall feel ashamed to meet an Indian, and almost wish that we could appear *black* in his eyes.

These scenes of crime and calamity are mournful objects for the traveller who examines them on the spot, and describes them in his journal. Their distance from Europe is far from diminishing the pity and sympathy which they demand from civilisation; they will find an echo in the heart of every charitable man, and will perhaps some day find an eloquent pen which shall, with all the energy of a just indignation, consign to public execration their authors and abettors.

Governments even, however tardily, begin to arouse themselves from their indifference to distant calamities. The English, that moral people, who are ever the first to connect themselves with those lofty and generous ideas which beautify the political complexion of the century, have given us a striking instance of the progress of moral principle in their government. This act, which philosophy, seated at the foot of the throne, dictated, by its organ, Lord Glenelg (Charles Grant), deserves to be written in letters of gold — to be published and republished in honour of the humanity and civilisation of the nineteenth century.

In 1834, the Caffres, to the number of 15,000 men, burst upon the peaceful colony of the Cape of Good Hope. Their invasion was marked by the most savage barbarities; and the colony, by this disastrous event, became burdened with the maintenance of 8370 unhappy fugitives, at the same time that it was despoiled of 51,000 head of cattle, 2339 horses, and 118,195 sheep, besides 369 houses being burnt, and 261 pillaged. The Government of the colony, it is true, promptly and effectively repulsed these Caffres, and punished their temerity. The account rendered by the local authority to the English minister relates that —

"In the course of the commissioner's progress in the census of the tribes of Gaika and Lambie, it was ascertained that their loss, during our operations against them, amounted to 4000 of their warriors, or fighting men, and among them many captains. Ours, fortunately, has not in the whole amounted to 100, and of these only two officers.

with children, those of Flinders Island had, during eight years, an accession of only fourteen in number!

Amidst the wrecks of schemes, efforts, and attempts to christianise, civilise, utilise[*], and preserve the aboriginal race, there remains yet to be adopted one measure, worthy of the liberality of the English Government, — viz., to listen and attend to the last wishes of the departed, and to the voice of the remaining few: — "Leave us to our habits and customs; do not embitter the days which are in store for us, by constraining us to obey yours; nor reproach us with apathy to that civilisation which is not

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There have been taken from them also, besides the conquest and alienation of their country, about 60,000 head of cattle, and almost all their goats. Their habitations have everywhere been destroyed, and their gardens and corn-fields laid waste. They have, therefore, been chastised, not extremely, but sufficiently."

Lord Glenelg, Secretary for the Colonies, expresses himself to Sir Benjamin D'Urban, Governor of the Cape, upon the above passage, in the following terms: —

"I am bound to record the very deep regret with which I have perused this passage. In a conflict between regular troops and hordes of barbarous men, it is almost a matter of course that there should exist an enormous disproportion between the loss of life on either side; but to consign an entire country to desolation, a whole people to famine, is an aggravation of the necessary horrors of war, so repugnant to every just feeling, and so totally at variance with the habits of civilised nations, that I should not be justified in receiving such a statement without calling upon you for further explanations. The honour of the British name is deeply interested in obtaining and giving publicity to the proofs that the King's subjects really demanded so fearful an exercise of the irresistible power of His Majesty's forces."

Never did a government express itself with greater humanity, greater political wisdom, on a victory which so much flattered its people's spirit of vanity as well as of vengeance. Public opinion applauded the reproof of Lord Glenelg; and the victorious colony sanctioned it, by abstaining from illuminations and similar barbarous manifestations of joy, often called forth by deeds not less barbarous. — *MS. Journal of the Author.*

[*] Those who have contemplated their transformation so far as to propose making them servants of the whites, have studied neither their instincts nor habits. From what has been observed of the two races, one may affirm, without dread of contradiction, that *it will be easier to bring the whites down to the level of the blacks, than to raise the latter to the ideas and habits of our race.*

ed for us; and if you can still be generous to nquered, relieve the hunger which drives us in r to slaughter your flocks and the men who them. Our fields and forests, which once hed us with abundance of vegetable and animal now yield us no more; they and their produce yours. You prosper on our native soil, and we famishing!"

SECTION VIII.

AGRICULTURE.

INTRODUCTION.

In the preceding pages it will have been seen how greatly the marine and land surveys of New South Wales and Van Diemen's Land assisted the carrying out of the geological inquiry which followed; how greatly, again, the geological investigation was instrumental to the study and appreciation of the climatic agencies, and the explanation of many of their obscure phenomena; and, finally, how effectually the combined facts, thus obtained, assisted in the farther inquiry relative to plants and animals, and the moral and physical condition of the aborigines.

The subject of Agriculture will appropriately form the present or concluding section of this work, because no branch of science is more dependent and more consequent upon other branches of physical inquiry; appearing, in even all its most important facts, as a mere result of previously-acquired studies.

From this admirable connection and wholesome concurrence of the positive sciences in the promotion of one which embraces all the most important and vital interests of human industry, it follows necessarily, that the delineation of the agricultural character of New South Wales and Van Diemen's Land, including both the general and specific character of soils, and their adaptation either to indigenous or exotic plants, will involve an unavoidable repetition of facts and observations already contained in the preceding sections.

To this will be added an inquiry into the state of agriculture, as it is actually practised in the two colonies, and also a survey of their pastoral operations.

The practical application of science will come next, not only to point out and correct mistakes and prejudices, if such are found to be entertained amongst farmers, but also to suggest the speediest, cheapest, and most attainable means by which the actual mode of farming or grazing may be improved, the forces and vitality of agricultural and pastoral lands preserved or exalted, and the crown or other unoccupied lands rendered available to industry.

AGRICULTURAL CHARACTER OF SOILS, ETC.

In the description of the configuration of New South Wales and Van Diemen's Land, the dividing mountain-range running from N. E. to S. W. was pointed out as the main and characteristic feature of that configuration, and around which all the phenomena connected with the geology of both the colonies had been found grouped.

In New South Wales, its average height was estimated at 3,500 feet above the level of the sea, and its average distance from the eastern coast at seventy-two miles.

The average fall of those eastern rivers, the sources of which may be traced to the crowning points of the ridge, would be therefore forty-eight feet to every mile; the average fall or slope of the land, however, intersected, as it is, by transverse mountain spurs, may be taken as double that of the rivers, even on the under-rated assumption, that the breadth of the valleys is not less than half the length of the spurs which enclose them.

The country to the westward of the dividing range, considered, for the better illustration of the subject, as within limits corresponding to those of the country lying to the eastward,—that is to say, considered only at a distance of seventy-two miles from the crest of the dividing chain,—was found to have an average fall of twenty feet in every mile, and the average fall of its rivers to be nine feet in the same distance.

The crest of the dividing range, and of the spurs shooting from it, which form as it were the uppermost structure of the country, was stated to be composed of crystalline and siliceous rocks, as granite, gneiss, sienite, quartz-rock, protegene, hyalomicte, and petrosilex porphyry, and of trappean rocks, as serpentine, greenstone, basalt, and trachyte.

The next structure, which geologically may be called a superstructure, but which, from its relative height, is lower than, and abuts upon the first, is composed, on both sides of the before-mentioned dividing range, of analogous, though not identical stratified rocks, as mica, siliceous and argillaceous slates, limestones, conglomerates, breccias, and sandstones.

On a lower level of these, are the alluvial deposits confined to valleys.

In Van Diemen's Land, the dividing range, winding its course, in the form of a Z, through the island, which it apportions into very nearly equal parts, has an average height of 3750 feet, and an average distance from the sea of forty miles; the average fall of the rivers may be estimated at ninety-three feet per mile, and the average fall of the country at 120 feet.

Its geological fabric is, with very slight variation, identical with that of New South Wales, not only in structure, but in the nature of the materials of which it is composed: the difference lies only in the kind of rocks which constitute the crust of the two colonies.

In New South Wales, granite, sandstone, and conglomerates preponderate; in Van Diemen's Land, porphyry, greenstone, basalt, and trachyte.

In the former, limestone is confined to few localities; in the latter, that species of rock is more diffused.

From this difference in the geological materials of the two colonies, it necessarily follows that their respective soils must be different also.

This conclusion is borne out by the results of actual observation.

The analysis of the preponderating soils of the one and the other colony, shows, at the outset, that the soils of New South Wales contain from a quarter to one third less of matter soluble in hydrochloric acid than those of Van Diemen's Land; and further, in the final determination of the constituents, the analysis shows a larger quantity of alkalies and salts in the soils of greater solubility, and a larger quantity of silica in those of lesser solubility.

In their external character, the soils of New South Wales and Van Diemen's Land are, nevertheless, alike; particularly those which are as yet untouched by the hand of man, and which possess, in both colonies, the same degree of softness, coherence, and porosity common to all virgin soils, together with a low specific gravity, and a proportion of organic to inorganic matter amounting to a third, and in one instance to a half, of the whole quantity.

Compared with the virgin soils which the writer has examined in Canada, the United States, Brazil, the Argentine republic, Guatemala, Mexico, and the islands of Bailly and Lumbock, those of New South Wales and Van Diemen's Land are greatly inferior in the amount of salts and alkalies they contain, and therefore in fertility.

To that comparatively low productive power of soils, there is nevertheless an indigenous vegetation,—luxuriant, healthy, and vigorous in its kind,—most admirably adapted to it; the Australian graminæ, which are tufted and delicate, and which yield an excellent support to animal life, show by incineration, that they do not contain the same quantity of alkalies as the English grasses, and therefore do not need a very rich soil for passing luxuriantly through all the stages of developement. The family of *Eucalyptæ*, likewise, which flourish all over the country, are most wonderfully adapted to it; as, by shedding their bark, the *Eucalyptæ* can dispense with the annual supply of alkalies which trees shedding their leaves would have extracted from the soil.

This wonderful adjustment of the organic to inorganic matter has been, nevertheless, disturbed: the same agency of civilisation which, as has been already shown, modified the nature of the normal climate of the two colonies, changed likewise the physical and the chemical property of their respective soils.

From the circumstance that, on the first introduction of tillage and grazing, the analysis of soils in particular fields was not performed, and the chemical nature of the first seed and the first crop not ascertained, it is difficult to determine the precise extent of this change, as regards soils. Judging, however, from the constituents of those untouched by the hand of man, the soils under tillage or pasturage have deteriorated in an agricultural point of view, having lost in salts and alkalies. Furthermore, they have deteriorated in a climatic point of view, as their power of absorbing moisture from the atmosphere has been curtailed, and that of absorbing solar heat has increased; while that of retaining heat, during terrestrial radiation, has decreased.

Be it however remarked, that the influence of civilisation, here spoken of, partakes more of the character of those unavoidable results which attend the transition epoch of all human progress, than of those ultimate effects of civilisation which, as regards Terra Australis, need as yet time and means ere they can be fully developed, and rendered ripe for a just appreciation of the civilising influence.

CLASSIFICATION OF SOILS.

The varieties of soils which are observed in the two colonies, may be traced not only to the kind of rocks characteristic of each colony, but to their respective configuration, and to the greater or lesser *denudation* and *renovation* of the surface, consequent upon that configuration.

Throughout the greatest portion of New South Wales and Van Diemen's Land, the fine and most valuable ingredients yielded by the rocks and vegetation, in the process of their decomposition, are generally carried away from their original sites by the rain-water. If the floor which is disintegrating is composed of siliceous rocks, the surface subject to denudation retains only that portion of silex and silicates which, from their specific gsavity, have resisted the action of the water-current; and, in that instance, it presents a deposit of loose and sterile constituents.

If the surface happens to be intermixed with conglomerates or sandstone, the alternate disintegration and denudation produces a hard floor, in the crevices of which the *Banksia* and a dwarfish *Eucalyptæ* can alone flourish. At times, that floor is covered with fragments of conglomerates or coarse sandstones, which have resisted the action of water, and against which a drift of siliceous with some aluminous earth is found accumulated. When, on the other side, the surface is composed of trappean rocks, or, when such are found near to it, a continual transformation of the protoxide of iron (in which the rocks have been shown to abound) into peroxide equally checks the growth of vegetation; and in that case, on an apparently rich reddish tract of hills, nothing but a scanty and stunted vegetation of *Mimosæ* is to be seen. The most remarkable exemplification of this, is in that portion of Cumberland (Van Diemen's Land) which lies to the north of Hamilton.

When, however, ridges or hollows lie in the way of the drift, the deposits from the upper country are found either lodged against the slope of the hills, or accumulated in basins and flat-bottomed valleys.

The sudden condensation of vapours in New South Wales, and their gradual condensation in Van Diemen's Land, have been pointed out, in Section III., as meteorological facts which distinguish the respective climates of these colonies. Their effects, as bearing upon the question before us, are obvious; and thus, in New South Wales, the denudation may be safely inferred to be greater, and more injurious to the country, than it is in Van Diemen's Land.

From what has been said, it follows that the soils of the two colonies consist of two distinct classes, within which all the minor varieties may be included: the *first*, impoverished by denudation, and which yields only pasture for grazing; the *last*, enriched by the drift, presenting every inducement for agriculture.

We shall now consider, in turn, each of these classes of soil, and the kind of industry employed to render available their respective powers of production.

PASTORAL SOILS.—SHEEP-BREEDING.

The aspect of the pastoral portion of New South Wales and Van Diemen's Land is novel, striking, and characteristic of the Australian zone. Its mountainous district presents nothing in common with the appearance of the Alps, or the Westmoreland, Cheviot, or Grampian hills; its plains are far from recalling the recollection of the steppes of South-eastern Europe, or of the Prairies, Savannas, Llanos, or Pampas; and the forest, which covers the greatest portion of the country, has nothing in common with the forests of Europe. A difference in lines, tints, and shadows seems to prevail, and to produce original effects in every part of the picture.

Throughout its whole extent, the pastoral ground may be said to present either the alternate fall or rise of a smooth undulating surface, sometimes running into flats; or one broken and riven, terminating in deep gullies or steep ridges. The *Eucalyptæ*, with its everlasting olive-green foliage, uniformly covers the surface, and, whether boldly erect and widely ramified, or stunted in its growth, rarely yields a shade.

This character of the forest prevents the vegetation of the grasses from being impeded. Judging from localities, untrodden by flocks and herds, which the writer met with, in the Australian Alps, in Gipps Land, and in some parts of Van Diemen's Land, that vegetation was luxurious beyond description, and extended from the level of the sea to the highest altitudes of the two colonies. Thus, on ascending the Australian Alps, the pasture was observed to be as rich, at an elevation of 5200 feet, as that which is met with around Lake King; which was also the case in Van Diemen's Land, on the lower parts of Ben

Lomond, Ben Nevis, Dry's Bluff, and Lake St. Clair, between an altitude of 3000 and 4200 feet.

The abundance and excellence of such pasture, combined with the mildness of the climate, could not fail to awaken the enterprising spirit of the first settlers to the advantages of pastoral industry; nor was their perseverance abated, either by the difficulties attending the acquisition of live stock, at such a distance as New South Wales, or the outlay of capital which the enterprise required,—or yet the obstacles and losses inseparable from shipments of such a nature, in a voyage of 15,000 miles, and which at that time required at least five months to accomplish.

Marvellous indeed must that epoch appear, in the annals of colonisation, to any one who, like the writer, has ventured on a journey to Australia by way of the North and South American (Spanish) colonies, of three hundred years' standing; and not less marvellous is the result, when it is borne in mind that hardly thirty years have elapsed since the first ram was imported into New South Wales, and that the number of sheep at present amounts to nearly 9,000,000!

Generally speaking, the earlier system on the stock-farms was both simple and unexpensive. For every 600 sheep, a shepherd was provided, whose wages and sustenance, under the system of assignment, and when circumstances were favourable,—that is, when the price of flour was low,—amounted to 35*l.* a year. The duty of the shepherd was to take the sheep out in the morning, and to bring them back again, in the evening, to the sheep station,—an establishment usually consisting of a bark hut, 8 by 12 feet in size, with or without a hut-keeper, and an adjoining enclosure, which sufficed to protect the flock, during the night, from the depredations of wild dogs and cats.

The keeping of the numerical account of the flock, washing and shearing the sheep, disposing of the wool and carcass, and providing the station with rations, comprised all the details of the business of a sheep-farmer in both the colonies.

The management of pastoral lands was as simple as that of the flocks. Those of the sheep-owners who were owners also of large landed property, covered it with their own flocks; those, again, who invested their capital in sheep alone, fell upon the unoccupied land belonging to the crown. If the tract which they came across suited them, they remained on it, erected, in a day or two, a bark hut, and, in the course of a fortnight, completed the sheep establishment, and applied for and obtained a squatting licence. If it did not suit them, they raised their camp and proceeded farther. In both instances,—that is, whether the sheep-run was private or crown property,—the choice of the daily pasture was left to the instinct of the animal; and, in nine cases out of ten, it was the flock which guided or determined the direction which the shepherd took. *Carpe diem* seems to have been the motto generally acted upon by the graziers: so long, then, as the herbage, thus singularly adapted for sheep, promoted their increase, the evil working of the system, or rather, the absence of all system, and its consequences, were lost sight of, in the immediate profitable result which such an increase realised. But, when that increase began to react on the pasture,—when the grass of the granted lands, and that of those in the vicinity of the eastern shores, began to disappear, and the nakedness of the soil to be exposed,—then, had not fresh grounds, with fresh pasture, been at hand, the sheep-owner would have paid dearly for this mismanagement of the pastoral lands. Fortunately, however, room was not wanting. The dividing range, which, in the early period of colinisation, limited the grazing operations, was soon passed over; and new pastures, as luxuriant as the first had once been, were discovered. Bathurst, Liverpool Plains, Manning, Moneiro, and Murrumbidgee, were soon overrun and covered with flocks, and pastoral pursuits again became replete with life and promise. The pasture, however, here, as in the foreground of the colony, began to diminish: the occasional burnings which were from time to time resorted to, in order either to ameliorate the pasture, or to produce a new growth from the roots of the grasses, did but accelerate the slowly but evidently approaching evils. Dews began to be scarce, and rain still more so: one year of drought was followed by another; and, in the summer of 1838, the whole country of New South Wales between Sydney and Wellington, the Upper and Lower Hunter River, Liverpool Plains, Argyleshire, &c., presented, with very few exceptions, a naked surface, without any perceptible pasture upon it, for numerous half-starved flocks.

In Van Diemen's Land, the evils of mismanagement, accompanied with that of drought, also attacked the flocks, but spared the pastoral land. The limited space of the island did not admit of squatting licences; there, every sheep-owner pastured his flock upon his own property; and although overstocking it as much as was done in New South Wales, still, by preventing burning as much as lay in his power, he saved his sheep-runs from an additional injury. This prohibition of burning was enforced in Van Diemen's Land, not because it was considered injurious to grasses or soils, but because the owners of flocks, not being squatters, but proprietors of the land upon which the flocked grazed, fenced those lands in, and, dreading the destruction of valuable fencing, abstained and prevented their shepherds from setting fire to the country.

Few improvements, either as regards the management of sheep, or of pastoral land, have as yet made their way into the colonies. Thus, what in Scotland and Silesia is called the art of breeding and rearing sheep by means of assortment, division, infusion of the best blood, and what may be termed rotation of pasture-ground, is still an unknown science in New South Wales and Van Diemen's Land.

The reason is obvious: the majority of wool-growers in Australia is composed of persons whose occupation in England was not that of a sheep-farmer, which is a science, as well as any other. They belonged mostly to the army or navy, or to the professional and commercial classes. Those, again, who were left in charge of the flock, had been anything but shepherds at home. Such improvements as were introduced by the minority, more practically conversant with the subject, had to struggle against the ignorance of subordinates. Then came the extraordinary profits which the mere increase of the flock, and of the quantity of wool, realised. The state of the market, which in every country regulates the line of industry, chalked out a very simple one for the sheep-breeders of Australia. The greatest numerical amount of sheep being shown to lead immediately to the best of all possible results, the increase of the stock was promoted by all practicable means, and the carrying out of the measure was left to the uncontrolled management of nature. Her bounty soon crowned the desire of the settlers, even beyond their expectation; but the concomitant conditions of the boon greatly modified its advantages. The country became overstocked; the pasture began to fail; sickness was introduced into the too large and unmanageable herds; the wages of shepherds rose; the capital of the mother country, which had hitherto helped to keep up the value of sheep, found a more profitable investment in banking operations and land speculations, than in the purchase of flocks; the manufacturer, too, looked more to the quality than the quantity; and lastly, other countries had entered into competition as producers of wool. Depreciation followed, and continued, until, in 1843 a reduction had taken place of ninety-six per cent. on the value of sheep, as sold in the latter end of 1838.

The melancholy reverses in private fortunes, and their effect on commerce and industry, can hardly be imagined in England; but the causes which gave rise to them may be easily understood.

To every reflecting and impartial mind, it must appear evident that it is not to *obstacles* or *impediments*, but to *facilities* offered to all who were in pursuit of fortune by a concurrence of most favourable, though transient, circumstances, that these colonial reverses may be traced.

They need create no alarm to those interested in the future progress of the colony. The easy, quiet, and smooth way of passing through life is incompatible with the *race* to which the settlers of Australia belong. Difficulty of position, labour, anxiety, hard struggles, and all the wear and tear of life, are the elements in which that race thrives, and in which the Anglo-Australians will not fail to thrive likewise, and to work out their own prosperity in the truly national way. As an instance of their readiness to meet any exigency, the Australians, unable, among many other difficulties under which another race of colonists would have sunk, to dispose of the carcasses of their sheep, have hit upon the ingenious expedient of boiling it up for the sake of the tallow, which, as seen in the London market, surpasses in quality that brought from the Baltic.

IMPROVEMENTS.

The field presented to the colonist for effecting improvements, both as regards sheep and pasture, is immense, and providentially remains as a reserve, if not to counteract the present depression, at least to insure a signal success for future speculations.

In accordance with that grand principle of agricultural economy which aims at producing the greatest quantity at the least expense, the settlers will undoubtedly turn their attention towards combining the reduction of their flocks with the increase of the wool. That reduction cannot be too much recommended, not only because a smaller number of sheep is more manageable under the true system of breeding and rearing; but as it is capable of being combined with the increase of the fleece, it may become both a gain and a saving in point of pasture, produce, and outlay.

The pasture, as shown from the nature of the soil and climate, is not of the most luxurious description. It is nevertheless wholesome, and extremely well suited to sheep. Six acres is the least that should be appropriated as an annual run for each sheep.

This run must likewise be properly apportioned, if not by fencing, which is only admissible on a property, and not on squatting ground, at least by preventing the flock from overrunning and picking out the best spots of the whole range.

Now this division of the run, with the object of securing a succession of good pasture, is so intimately connected with the necessity of a division and assortment of the sheep, for the sake of regular breeding and rearing, that the one necessarily implies or follows the other, and causes a mutual reaction of a most beneficial kind.

Those who have visited the sheep farms of Silesia, —for instance, Wartenberg, the estate of Prince Biron of Courland, where, amongst a flock of 25,000 sheep, the blood, in breeding, is as rigorously attended to, as amongst the breeders of horses, and where the grazing land is as systematically divided as any series of agricultural fields for rotation of crops, —those, I say, who have visited this estate, will have got an insight into the working of a most admirable system in pastoral economy.

In the United Kingdom, no sheep-farm so much resembles that of Wartenberg, and none can be more strongly recommended to the imitation of the Australian wool-growers, than the farm of Patrick Sellar, Esq., in the county of Sutherland. (Scotland.) From its extensive flock (10,000 sheep), and the range of the run, that farm is able to exhibit the best principles in the management both of the flock and food.

Upon it, the annual increase of the sheep is subservient to the increasing of the fleece and the carcass; while the range of pasture is looked upon, not so much as affording means of *numerically extending* the flock, as of *raising its valuable qualities higher and higher*.

Fifteen years ago, when the writer was exploring the north of Scotland, he visited Tongue, and the sheep-farm of Strathnaver, which lays along Loch Naver and the river of the same name. In regard to that sheep-farm, his note-book records the following facts: —

"The mountainous district about Strathnaver revives many recollections of Silesia. . . . . .

"The pasture appropriated for sheep is here divided, like that in the environs of Lissa or Wartenberg, into a winter and summer run; which, again, are subdivided into as many sections as are required for the assortment of the sheep according to their age, sex, and condition, and according as they are reserved for market or for breeding.

"Thus the sections, twelve in number, called here herdings, are separately appropriated to ewes, rams, ewe-hogs, wedder-hogs, ewe-hogs once shorn, and wedder-hogs once shorn. . . . . . The greatest stress is laid on the selection of the tups or rams, and on the sorting of the ewes: this is more carefully managed than in Silesia, or amongst us in the Duchy of Posen. The importance attached to the point may be easily conceived, from the circumstance which I witnessed at Morvich, of every ram and ewe, before being put in a proper herding together, being handled and well-examined by Mr. Sellar himself, who weighed the ewes in his hands, noticed their general size and proportions, then particularly examined the head, neck, breast, shoulder, rib, back, and tail, looked at the quality of the wool, and decided upon the ram, under the number by which he was designated and booked, which should be most likely to counteract the defect found, or still further to ennoble the blood of the future progeny. . . . .

"The sorting of the lambs, after speening time, is not less rigorously attended to. . . . .

"The results which Mr. Sellar has obtained by his system are immense, and may be understood by the remarkable fact, that while the fleece of the original Cheviot breed, from which the Sutherland flock was bred, weighs in Roxburgh, on an average, from 2½ to 3½ pounds, the weight of that of Strathnaven averages from 4 to 5 pounds. Again, the weight of a quarter of mutton of the original sheep averages from 12 to 18 pounds, while that of the improved breed ranges from 18 to 26!"

This system of sheep-farming, which has secured to Mr. Sellar such splendid success, combining, as it does, all the most vital conditions of pastoral industry, is likely to answer best for all the exigencies of an Australian grazier. By the adoption of that system, a reduction of the flock, and an increase of the carcass and wool, appear practicable, and, if successful, will no doubt prove profitable; as, if one flock produces as much as two flocks did heretofore, the profit is obvious, not only in the saving of the shepherd's wages, but also in the economy of pasture.

Besides the division of pastoral land, which the system of Mr. Sellar involves, and which will most strikingly tend to the improvement of pasture, two other considerations of paramount importance are here offered for the consideration of the Australian settler.

The first is the necessity of introducing a gradual clearing of pastoral land property from the dead timber, that not only obstructs the vegetation, but gathers a great deal of valuable wool from the passing flock, which wool is thus lost. It is astonishing how much may be done to effect this clearing, by employing only one man with a yoke of bullocks. On Formosa, the estate of the deservedly lamented Mr. Lawrence, in Van Diemen's Land, many miles were thus reclaimed, which, before they were cleared, were unavailable for sheep and cattle, by reason of the dead timber alone.

The second consideration refers to the advisability of putting an end to the wilful burning of the sheep-run by the shepherd.

In the Meteorological Section, the fact was rendered evident, that the vegetable matter of the soil is a powerful concomitant of the agencies modifying the absorption and emission both of heat and moisture. Now, local experience and observation have proved that overstocking the country has, together with drought, deprived the surface of the land of the tufted though thin turf, above which the high pasture grass grew; and that the vegetable fibres or roots of grasses, left thus exposed and unprotected, are consumed along with the coarse growth which it is the object of burning to destroy.

Again, in the course of this section, it has been shown that the soils of the country are, from their position, and from the effects of the rain, *subjected to denudations.*

Now, from the small quantities of aluminous matter detected throughout the soils of New South Wales, it becomes obvious that the *only effective check* upon the influences of that denudation, is *the preservation either of such scanty vegetation as does exist, or, at least, of the woody fibre, which more or less contributes to the fixing and consolidating of the soil.*

THE AGRICULTURAL REGION, AND AGRICULTURE.

In passing from the pastoral to the agricultural districts, the traveller exchanges a wild solitude, a rude independence, a shifting and temporary industry—images quite of an Australian complexion—for the scenery of the Old World,—towns, villages, comfortable homesteads, tilled and enclosed fields, and gardens. Great as the contrast is, it is nevertheless the work of only twenty years!

On England's taking possession of New South Wales, the district suited to agriculture appeared, like the pastoral, just as the Creator had formed it; unknown in its extent, or its communications and outlets; and overgrown with trees, shrubs, rushes, and grasses, which rendered the penetrating into it, if not a question of life, at least one of most extraordinary exertion and privation.

At present, New South Wales possesses 120,000 acres, and Van Diemen's Land 160,000 acres, of tilled land. In some parts, the two colonies have roads which would not disgrace England herself, and tolerably safe communications and outlets throughout: and this conquest over a wild and primitive nature, achieved in less than half a century, is the best proof of the progress these colonies have made; speaking volumes in favour both of the ruled and the rulers.

Wheat, barley, oats, Indian corn, tobacco, potatoes, turnips, and English grasses have been objects of cultivation ever since the earliest settlement. The introduction of the vine followed; and, from the importance its culture now assumes, this introduction will no doubt be viewed at some future period as an era in the history of the colonies.

The English plough and harrow is employed in cultivation, and the mode of working the land is modelled upon that of England, and followed up to that model as far as local circumstances render it convenient or profitable. Manuring, rotation of crops, fallowing, thorough or superficial draining and irrigation, are as yet far from being common operations: they are confined to particular farms only; and although the experiments have been crowned with signal success, they have hitherto found few imitators.

The agricultural calendar which guides and regulates the farmer in the routine of annual labour and farm management, is just the reverse of that to which he was accustomed in his native land.

The month of *January*, in New South Wales and Van Diemen's Land, corresponds, as regards season, with the month of July in European latitudes; but as regards agricultural occupations, it corresponds with August. Thus in that month the reaping and getting in of the wheat harvest is brought to an end in the two colonies; the wheat is thrashed, and the farmer gathers the stubble of the early maize, ploughs the land for the next wheat crop, and weeds the potato fields.

The *February* of Australia, which is the August of Europe, is the month in which the barley harvest and the sowing of the turnips begin; while the ploughing of the land for the next wheat crop, and the clearing of the potato fields, continues. In New South Wales, since the introduction of the tobacco plant, the month of February is also the proper time for cutting and drying the tobacco leaves.

Towards the end of *March*, which is the September of Europe, the farmers commonly secure all their maize crops, the stubble of which is, in the north of New South Wales, sometimes ploughed in for wheat. The sowing of turnips also continues.

In *April*, which is the same as our October, the gathering in of the maize still proceeds, and the sowing of the wheat begins. The second cutting of tobacco is likewise commenced; and the corn stacks in Van Diemen's Land, where the moist season advances, are thatched and put in order. In this month the potatoes are usually dug up and partly stored.

The month of *May*, corresponding to the November of Europe, allows the farmer of New South Wales to proceed with, and bring to a close, the sowing of his wheat, which in Van Diemen's Land commonly terminates the latter end of April. The cutting of tobacco and the gathering of maize is completed, as is also the storing of potatoes.

June, the mid-winter, or December of Europe, is employed in New South Wales in sowing the latest wheat, clearing the maize land of the stubble, and in both colonies in thrashing out the corn.

July, the January of Europe, is the month in which the farmer of New South Wales prepares the land for early maize, tobacco, and potatoes. In Van Diemen's

Land, he breaks new lands, and commences grubbing out the stumps from the corn fields.

August, the February of Europe, is commonly devoted to preparing the land for spring crops, and, in the north of New South Wales, to planting potatoes.

September, the European March, is the time for sowing spring wheat and barley, and, in some parts of the two colonies, artificial grasses. In this month a general planting of maize and potatoes takes place, and turnips are removed.

In *October*, the April of Europe, the farmer completes the planting of maize and potatoes, and prepares the land for tobacco.

In *November*, the May of Europe, the wheat harvest in the northern parts of New South Wales begins. The ploughing and preparing land for the early maize follows, as also the making of hay.

December, the June of Europe, is the month of general harvest. The clearing of the September maize and potato fields is attended to, as also the topping of the tobacco and the planting of new maize.

In New South Wales, the cultivation of the above articles extends throughout the colony. That portion of the country, however, which, from its system of working, and range of tillable land, deserves to be included within the agricultural district, is confined to the valley of the Karua, which is limited in the extent of its cultivated, but not of its cultivable land, and of which the best tracts are in the possession of the Australian Agricultural Company; to the valley of the Hunter, composed of the confluent valleys of the Goulbourn, Page's, Patterson, and Williams rivers; to the valley of the Paramatta; to the Hawkesbury, South Creek, Mulgoa Creek, the Nepean, and the Wollondilly. The district of Bathurst, along the rivers Macquarie and Campbell, down to Wellington Valley, deserves also to be included in the agricultural district, as likewise the heads of the Belubula river, not so much on account of the existing agricultural industry, as on account of the richness of the soil, and the capabilities offered for the introduction of agricultural improvement.

In these localities, a good many farms are in a very forward state, many exhibit remarkable improvements, and some display only partial attempts, all of which are, however, in the right direction.

The farms of the Australian Agricultural Company at Strout and Booral, the most northern farms of the colony, may be regarded as the first in the rank of improvement. The farm buildings are of the best construction; the tilled lands are almost entirely clear of timber and stumps, well fenced in, well ploughed and worked, and presenting, on the whole, gratifying proofs of well-bestowed capital and labour. The orchard and vineyards of the Company at Tahlee, (Port Stephen,) which produce the choicest grapes, oranges, and lemons, are not less worthy of notice. It is this orchard that shows most forciby the extensive range which the bountiful climate of New South Wales embraces in isothermal lines, as there, the English oak is seen flourishing by the side of the banana, which again is surrounded by vines, lemon, and orange trees of luxurious growth.

To the southward of Port Stephen are a series of thriving farms, spread along the Goulburn, Pages, Hunter, Patterson, and Williams rivers, and which comprise an agricultural district of 2000 square miles in extent. The excellent harbour Newcastle, good water and tolerable roads, a coal mine, a soil well adapted for wheat, barley, turnips, the vine, and European fruits, and a situation the most favourable to the application of irrigation, render this district one of the richest and most important in the colony.

To the westward of Sydney, and as far as the Nepean river, the agricultural lands are more extensive than the agriculture. Some few farms on the Hawkesbury, those of Captain P. P. King, of Mr. R. Jones, on the South Creek, and of Mr. W. E. Cox, on Mulgoa, are the only ones which, in the midst of a good deal of cultivation visible about Penrith, Richmond, Liverpool, and Paramatta, exhibit much agricultural skill and industry.

On crossing the Nepean to Camden and Argyleshire, the farming, with some exceptions, does not improve; sheep-breeding here being the primary object. In the list of exceptions alluded to, the estate of Camden stands prominently, being surpassed only by the farms of the Australian Agricultural Company. The estate is the property of Messrs. James and William M'Arthur, whose name and family have been constantly associated with improvements in the colonial industry. The situation of the estate is picturesque; its geological character, its position on the river Nepean, and its proximity to Sydney market, are extremely favourable to agriculture. A great deal of progress has been already made, to which the farm and the grounds, orchards, and vineyards, that surround the neat residence, bear ample testimony. But still the greatest work remains to be done. I allude particularly to irrigation, for which time and cheap labour are alone wanting. It is to Mr. M'Arthur that the colony is indebted for the bringing out, at his own cost, several German families from the vine-growing districts*, for the sole purpose of introducing the most approved mode of cultivating the grape, for raisins and for wine. Both objects have succeeded

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* "Camden (New South Wales), 26th Dec. 1839. — Camden, the immense estate of Mr. James MacArthur, lay on my way from Sydney, as if to relieve the wearisome monotony of the land. I found there all that we love to find out of cities, — society, books, a nice house, a garden, plenty of fruit, and kind, agreeable, well-informed hosts. But notwithstanding these comforts, so rarely found in a new

country, I met with objects which interfered with my enjoyment, and produced a melancholy feeling in my mind.

"I had gone with my host to look at the farm, the fields, and the vineyard,— contiguous to which last stood in a row six neat cottages, surrounded with kitchen gardens, and inhabited by six families of German vine-dressers, who emigrated two years ago to New South Wales, either driven there by necessity, or seduced by the hope of finding, beyond the sea, fortune, peace, and happiness,— perhaps justice and liberty. The German salutation which I gave to the group that stood nearest, was like some signal-bell, which instantly set the whole colony in motion. Fathers, mothers, and children came running from all sides to see, to salute, and to talk to the gentleman who came from Germany. They took me for their fellow-countryman, and were happy, questioning me about Germany, the Rhine, and their native town. I was far from undeceiving them. The sincere, the heartfelt pressure of hands which I received, under the idea that I was a German, was too delightful to permit me to destroy the illusion. I felt truly their friend, and was willing that they should call me their countryman, treat me as such, offer me their Christmas cake, present to me their children, and say to them, 'This gentleman comes from Germany; he is a German, like we are;' which announcement was followed on their part by numberless bows, obeisances, and kissing of hands! All smiled: nevertheless, in their gratified countenances I remarked an indefinable expression, which had more to do with sadness than with mirth. I leant against the verandah: they surrounded me, listening with the most intense interest to the answers which their questions called forth. The women seemed only to support and suckle their infants mechanically; the men neglected their smoking; the eyes of all were fixed on mine, as if they feared that I should vanish from their sight, or as if they could read their destiny in my looks. After talking of various matters, they at length all simultaneously cried, 'But are you not come here to stay with us? Oh, do stay! *we shall not then be so alone!*

"Never shall I forget the expression of their faces on hearing my negative: they looked at each other as if to say, 'We ought to understand this,—*he* has reasons for returning to Germany; *we*, alas! know none but those which forced us to quit it!'

"And yet, in a material point of view, their condition is more happy. Abundance, health, security, liberty, and justice procure for them advantages with which they were very imperfectly acquainted in their native land.

"It is the regret with which every emigrant naturally looks back to the country he has abandoned, added to a feeling of isolation, that weighs so heavily on the hearts of these poor vine-dressers. To proceed to a new country, in a number sufficiently large to form a nation or community within itself, greatly relieves and moderates the evils of emigration; but to abandon our country for another, where the people remarkably well; and, whether fermented or distilled, these grapes yield a wine and brandy of superior quality.

In Van Diemen's Land, the agricultural districts are superior in appearance to those of New South Wales. The details of farms and farming are better understood and defined, and the practical results are such, that no country reminds the traveller so much of the *old one* as Van Diemen's Land. There, the tasteful and comfortable mansions and cottages, surrounded by pleasure-grounds, gardens and orchards, the neat villages, and prominently placed churches, forming as it were the centres of cultivated plains, divided and subdivided by hedgerows, clipped or bushed, and through which an admirably constructed road winds across the island, are all objects which forcibly carry back the mind to similar scenes of rural beauty in England and Scotland.

have nothing in common with us but the bond of the same humanity, is to renounce our nationality and our race,—two things which are not given to man that he may cast them off whenever it pleases his fantasy. The language which the one establishes, and the character to which the other gives birth, are insuperable barriers to amalgamation, and constant causes of isolation. We may strive to bend our character, and to assimilate it to that of the country in which we live, but which is not *ours;* we may make a certain approach towards perfection in a language which we can speak, but which is not our mother-tongue; and, nevertheless, the smallest occasion will serve to make us feel that we are strangers, far from our own soil.

"'We already speak tolerable English,' said the Germans 'but yet we find it very difficult to explain ourselves as we would wish to do: no one here understands German. Ah! if Mrs. MacArthur, who is so kind, — if Mr. MacArthur, who is so generous,—understood it, they would at least know how grateful we feel towards them.'

"How many, many times —an object of kindness on a foreign soil — have I not been in their situation, and shared their feelings! How many difficulties, too, have I not conquered, in the study of languages which have no affinity with my own! and yet, whenever the heart and soul have been moved, how difficult have I found it to adapt them to the faintest expression of that which moved me. It is on such occasions that the recollection of country is recalled, and the sentiment of nationality revives." — *MS. Journal of the Author.*

As in New South Wales, the agricultural industry chiefly spreads over valleys, which are superior to those of the sister colony as regards their extent of available lands, and the fertility of their soil. Of these, the valley of the Tamar is the largest and the richest, both as regards its capabilities of present production and fertility, and those which invite to future improvements. It stretches from north to south into the centre of the island, and ramifies in the directions of the Meander, Lake, Blackman's, Macquarie, South and North Esk rivers. Its length, from the head of the Macquarie to George Town, is 100 miles; its average breadth may be estimated at thirty, and its superficial extent at 3000 square miles. It has forty miles of inland navigation for vessels of 600 tons, and the best macadamised roads cross it in every direction. Its sides are prominently indented with bold, erect ranges of greenstone, which, under the process of disintegration, are yielding to its soil the most valuable elements of production. From the nature of the drift, the eligibilities of the land and water communications, and particularly from the position of the valley relatively to Lake Arthur, which lays above it at an elevation of 3700 feet, forming a natural reservoir for irrigation, the valley of the Tamar constitutes as important a portion of the island as the valley of the Hunter does of New South Wales.

Next to it, in extent and agricultural importance, is the valley of the Derwent, which is composed of the valleys of the Jordan, Ouse, and Clyde. It is more broken and indented, and more elevated at its head, than the contiguous valley of the Tamar, and it offers to agriculture a smaller proportion of readily available land. For improvements, however, whether on private or crown lands, it presents a wide field, capable of largely adding to the agricultural resources of the island.

The vale of the Pittwater, accompanying (with its coal mines), the course of the Coal river, and the vale of the river Huyon, with its inland navigation, and the flanks of its ridges, bearing the richest soil and vegetation, form the two last, but not the least valuable, valleys of Van Diemen's Land.

Besides these, several minor vales, on the northern, western, and eastern coast of the island, deserve to be noticed; some as already supplying the market with agricultural produce, some as waiting only for the hand of industry to be rendered productive. Of these, the cultivated land of Port Sorell, Emu Bay with the Hampshire hills behind, Circular Head with its fine tilled fields spreading over the projecting point of land, and Woolnorth, surrounded with marshes open to improvement, compose the agricultural littoral to the west of Port Dalrymple. To the east are the flat-bottomed, marshy, scrubby valleys of Forrester, Bubiala, and Anson's rivers, which offer every inducement to agriculture, but require, like other parts still in a state of nature, an outlay of capital and labour.

The farms of the above valleys are numerous. Generally, it may be said, in respect to them, that they exhibit the appearance of English farms: several, indeed, upon which the industry of their owners has carried out every kind of improvement, in buildings, fencings, working of the land, and particularly in draining and irrigation, bear the strongest resemblance; while others show that capital and time only are wanted to assimilate them to those of the "old country."

Of all the farms which came under the writer's notice, none claims greater attention, and deserves higher encomium, than the farm of Mona Vale, the property of William Kermode, Esq., M. C.

On that farm, the introduction of improvements has proceeded gradually, systematically, and according to the best digested principles of agriculture: not the immediate, but the ultimate object has been kept in view; and the expense, labour, perseverance, and industry lavished upon it have been rewarded by a success which has exceeded the expectation of the proprietor.

The farm is situated at the eastern extremity of the valley of the Tamar. Its surface is undulating; its highest ground consists of sandstone, limestone, and greenstone; the lower lands are composed of large marshes, and some fine alluvial tracts, through which winds Blackman's Creek, and the Macquarie river, both draining a greenstone range, distant about fifteen miles from the farm.

During the greatest portion of the year, and when water is most needed, these watercourses dry up, the range from which they come not being of sufficient height to feed rivers falling at a rate of ninety-three feet per mile.

This farm suffered, therefore, from two opposite evils: one part of it lay under marshy water, and was thus rendered sterile; the other consists of an arid soil, and therefore greatly suffered during the drought.

The improvements on it have been naturally directed to the best mode of draining the marshy tract, and of irrigating the whole.

By the friendly assistance of Captain Cotton, civil engineer, of the Madras presidency, and at that time in Van Diemen's Land, Mr. Kermode was enabled to proceed in his enterprise with the certainty of success. He dammed up Blackman's Creek; and, finding at a distance of twelve miles from his farm, and at an elevation of 1200 feet above it, the basin of a former lake, to which one branch of the Macquarie river could be traced, he filled up the breach through which the waters of the lake had forced their way out, threw up embankments, erected sluices, and in one winter retained and secured, for the next summer season, 75,000,000 cubic feet of water.

The work at the outset was approved of by the Colonial Government, and, when completed, was personally inspected by the Governor (Sir John Franklin), who, foreseeing all the advantages which would hence accrue to the colony in general, and to those farmers in particular whose estates were below that of Mr. Kermode, acceded to his application, that the grounds of the reservoir should be exempted from public sale, and considered henceforth as a crown reserve.

The liberality of this enactment proved the care of the Colonial Government for the interests of the agriculturists. The latter, however, slaves of prejudice and custom in every country, and in every country most inimical to innovation or improvement, until the advantages of such are too palpable to be denied, refused for some time to take their share in the expense of embankment. But the five tons of hay per acre, which Mr. Kermode raised by means of irrigation, where not a blade of grass grew previously, was a result calculated to strike the eye of everybody: theirs had at length become opened, and the subscriptions raised by them in 1842 for improving the embankment and sluices, and for extending the irrigation, established for ever that most powerful agricultural agent in Van Diemen's Land.

The already-named Mr. Kermode produced, by draining and irrigating, from a sterile swamp of 500 acres, five tons of hay per acre. He moreover reclaimed, for meadows, more than 1000 acres; and raised from five to six tons of potatoes on an acre, on which, previously to irrigation, nothing was known to grow. Nor was the superfluous water lost sight of, being skilfully applied to turn a mill built on the farm, for the purpose of performing the thrashing, winnowing, and grinding, and the use of which, in case of stabling or stall-feeding of milch cows, — a system which cannot be too much recommended, on account of the manure it produces, — may be still further extended to cutting the straw, &c.

As yet, that farm, with two exceptions, stands alone in point of agricultural improvement, produced by means of irrigation; but it is not so forward in respect to cropping and the mode of cultivation.

The farm of the Van Diemen's Land Company, and those of Norfolk Plains, are in that respect in a most advanced state: the rotation of crops, and mode of working the land practised there, being truly admirable. The farm of Circular Head, that of Mr. William Archer's, called Brickendon, those of Messrs. Thomas and Edward Archer, the estate of Cressi, and that of Quamby, belonging to Mr. R. Dry, may be ranked with the best farms of England.

Again, the farms situated on the Meander river, in what is commonly called Westbury district, those on the North Esk, which extend from Launceston down to Ben Lomond, with those of the district of Morven and of South Esk, embracing the Vale of Avoca and Break-o'-day, are all of a superior character.

In the valley of the Jordan, from its head down to Brighton, a distance of about thirty miles, there are also a series of very flourishing farms. In the great valley of the Derwent, the farms of Mr. Barker (Rose Garland,) of Mr. Jamieson, and Mr. M'Dowell, stand pre-eminent among a good many others, the agricultural taste and industry displayed in which entitle them to praise and notice.

To the above general survey of the state of agriculture in New South Wales and Van Diemen's Land, I append a detailed examination of forty-one different soils, in different colonial farms, with the view not only of illustrating still farther the subject under consideration, but also of contributing some fresh data to the important question relating to the causes of the fertility or sterility of soils in general.

Before this examination is entered upon, a few words are needed, to explain upon what plan it was conducted, and by what means facts were collected, results obtained, and conclusions arrived at.

In order to simplify and shorten the inquiry, and to combine the general with the specific object in view, only three kinds of soils were selected from each farm; viz.—1st, that which the farmer declared to be of the highest productive power; 2dly, that which he pointed out as being of the lowest; 3dly, and lastly, that which he characterised as "*particular soil*," that is, a soil which was either apparently fertile, yet produced nothing, or which was externally and in situation similar to other soils, but on which the crops more frequently suffered from frost and drought than on those in their immediate vicinity.

Each kind of soil was then examined with regard to the method under which it was cultivated, and also with regard to its external character; that is, to its colour, cohesion, divisibility, and porosity; likewise with regard to its position as connected with the subsoil and the slope of the country, its exposure to the sun and the prevailing winds, and its situation with reference to the prominent geological features of the farm.

Its physical character was next investigated;—1st, as respected its power of absorption of solar rays; 2dly, its power of terrestrial radiation, or emission of heat; and lastly, its power of absorbing atmospheric moisture.

The first of these points was deduced from the difference of temperature which existed between a thermometer covered by a soil one-twentieth part of an inch in thickness, and a naked reflecting one; both being exposed to the action of the sun at an equal degree of inclination; the degree of temperature shown by the reflecting thermometer being considered as zero, and the difference obtained, being registered with a sign of +: thus, if the reflecting thermometer showed 70°, and the covered showed 78°; the kind of soil under experiment had + 8° of absorption.

The second point was deduced from the difference which existed between a thermometer covered by a soil one-twentieth of an inch in thickness, and exposed to radiation in a clear night, and a thermometer screened from such radiation, and placed in the immediate vicinity of the first; the degree of temperature shown by the screened thermometer being considered as *zero*, and the difference obtained being recorded with a sign of —: thus, if the one screened from radiation showed 60°, and the one covered, and exposed to the emission of heat, showed 55°, the kind of soil under experiment had – 5° of terrestrial radiation.

The third point was arrived at, by observing the difference which was found to exist between the weight of 100 parts of a soil deprived of its hygrometric water, and the weight of that same soil after it was exposed during twenty-four hours to the action of a saturated atmosphere: the increase of weight being expressed numerically, and recorded, under the head of capacity for moisture, with a sign of +.

Lastly, came the chemical examination of the soil, the analysis of which was twofold; one determining the quantity of soluble matter in 100 parts, the other determining the proximate constituents of the same.

NEW SOUTH WALES.

Soil No. 1.

The locality of this soil is an old basin in the valley of the Karua; it is taken from Strout (Garden of Eden), farm of the Australian Agricultural Company. It is an alluvial soil, of a clayey nature, formed from the adjacent hills, which are composed of greenstones and porphyries. It is light, soft to the touch, easily crushed between the fingers, of sufficient cohesion to resist drought, and of sufficient permeability to allow the quick escape of the superfluous rain-water. Its colour is dark brown; it is very easily worked, has not been manured, and is every second year under a crop of wheat. Its subsoil is a clayey diluvium. The acre produces 20 bushels of wheat. Specific gravity, 1·9.

Physical Character.

Power of absorption of solar heat	+ 14
Power of terrestrial radiation	− 4
Capacity for moisture	+ 6

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	19·74
Insoluble in acids	80·26
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	18·44
Water	6·53
Silica	56·63
Alumina	10·15
Peroxide of iron	4·00
Carbonate of lime	2·70
Sulphate of lime	1·20
Magnesia (traces).	
Loss	0·35
	100·00

SOIL No. 2.

This soil belongs to the same farm as No. 1., but the elevation of its site is somewhat greater. It is an alluvion, heavier, coarser, and not so easily crushed between the fingers as No. 1.; but in respect to cohesion and permeability, it is similar. Its colour is more red; it is manured, and bears alternately crops of wheat and potatoes. Its subsoil is the same as that of No. 1. It yields 26 bushels per acre. Specific gravity, 2·2.

Physical Character.

Power of absorption of solar heat	+ 11·0
Power of terrestrial radiation	− 2·5
Capacity for moisture	+ 7·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	33·07
Insoluble in acids	66·93
	100·00

Constituents of 100 parts:—	
Animal and vegetable matter	15·60
Water	5·50
Silica	59·80
Alumina	9·00
Peroxide of iron	1·90
Carbonate of lime	2·00
Sulphate of lime	4·70
Potash and soda	1·50
Magnesia (traces).	
	100·00

SOIL No. 3.

This soil lies on a farm called Briton Coast, belonging to the Australian Agricultural Company. The farm consists of 120 acres, and is in the hands of a tenant, Mr. Nichols. The soil lies in the flat-bottomed valley of the Karua. It is an alluvion of a clayey nature, formed partly by the drift deposited during occasional inundations of the river, partly by the denudations of the Grauwacke and Porphyry hills of the immediate vicinity. It is light, tolerably soft to the touch, porous, and easily crushed between the fingers. Its colour is light brown: it is easily cultivated, and has been ten years under cultivation, but is not manured; its subsoil is, in its external character, of the same kind as the preceding soils. It is cropped with wheat and maize alternately; producing of the first, 25 bushels per acre; of the last, 40 bushels. One bushel of wheat is used in seed per acre. This soil is considered by the tenant to be of the highest productive power.

Physical Character.

Power of absorption of solar rays - - -	+ 7
Power of terrestrial radiation - - -	— 2
Capacity for moisture - - -	+ 8

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids - - - -	26·51
Insoluble in acids - - - -	73·49
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter - -	7·30
Water - - - - -	4·00
Silica - - - - -	65·73
Alumina - - - - -	12·42
Peroxide of iron - - - -	3·75
Carbonate of lime - - - -	6·20
Sulphate of lime - - - -	0·60
	100·00

Soil No. 4.

This soil is the subsoil of the soil No. 3., and identical with it as regards its external character. It is taken at a foot deeper from the surface.

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	23·26
Insoluble in acids	76·74
	100·00

Constituents in 100 parts: —	
Animal and vegetable matter	8·10
Water	3·00
Silica	65·40
Alumina	8·90
Peroxide of iron	4·50
Carbonate of lime	6·50
Sulphate of lime	2·50
Potash and soda (traces).	
Magnesia	1·10
	100·00

SOIL No. 5.

Belongs to the same farm, but is taken from a situation a little higher than Soil No. 3. It is alluvial, and less exposed to inundation; softer, lighter, more easily crushed, less porous, more adhesive, and less red in colour, than No. 3. It is easily cultivated, and is not manured; its subsoil is clayey, but coarser than No. 3. It is alternately under tobacco and wheat, producing of the first 1200 lb. per acre; of the second, it takes one bushel and a half in seed, and gives in return 18½ bushels per acre. This soil is held by the tenant to be of the highest productive power.

Physical Character.

Power of absorption of solar rays	+ 12
Power of radiation	— 4
Capacity for moisture	+ 5

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	25·75
Insoluble in acids	74·25
	100·00

Constituents in 100 parts:—

Vegetable and animal matter	9·00
Water	4·00
Silica	63·00
Alumina	15·00
Iron	4·00
Carbonate of lime	3·20
Sulphate of lime	0·80
Magnesia	1·00
	100·00

SOIL No. 6.

On the same farm, and on the same level as the preceding one, from which it differs only in colour, being of a lighter shade. It is alternately under wheat and tobacco; takes one bushel and a half of seed to the acre, returns 25 bushels; is manured, and is estimated by the tenant as a soil of high productive power.

Physical Character.

Power of absorption of solar rays	+ 11·7
Power of radiation	— 0·3
Capacity for moisture	+ 0·7

Chemical Character.

Solubility of 100 parts:—

Soluble in acids	30·30
Insoluble in acids	69·70
	100·00

Constituents in 100 parts:—

Vegetable and animal matter	10·00
Water	5·20
Silica	53·70
Alumina	19·20
Peroxide of iron	3·20
Carbonate of lime	2·50
Sulphate of lime	4·20
Potass and soda	0·80
Magnesia	1·20
	100·00

Soil No. 7.

Belongs to the same farm; is situated under the foot of the Grauwacke range, and has been formed by its disintegration. Its site is a slightly inclined plane; it is not subject to denudation, but rather to accumulation of fresh drift from the hills. Its specific gravity is low, and its colour a light grey. It is finely granulated; yet, from its clayey quality, aggregates in small lumps, which are friable and easily crushed between the fingers. It is not unctuous, but feels dry and dusty. The presence of vegetable fibre gives it a permeability sufficient to drain the surface-water. It is easy of cultivation; is not manured; produces wheat; requires two bushels of seed per acre, and gives ten bushels in return: every alternate year it lies fallow: specific gravity 1·40.

Its subsoil is mixed with clay of a coarser kind than the surface soil.

It is called by the farmer a soil of the lowest productive power.

Physical Character.

Power of absorption of solar rays	+ 6·6
Power of radiation	− 3·5
Capacity for moisture	+ 2·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	10
Insoluble in acids	90
	100
Constituents in 100 parts:—	
Vegetable and animal matter	6·80
Water	2·00
Silica	70·10
Alumina	16·20
Peroxide of iron	0·20
Carbonate of lime	2·50
Magnesia	0·20
Loss	2·00
	100·00

SOIL No. 8.

Lies adjacent to the former soil, and is identical with it, as regards situation, texture, and other external appearances; the only difference consists in its being manured. It requires the same quantity of seed wheat, and produces 18 bushels in return. Like the preceding soil, every alternate year it lies fallow.

Physical Character.

Power of absorption of solar rays	+ 14·0
Power of terrestrial radiation	— 2·5
Capacity for moisture	+ 6·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	25·30
Insoluble in acids	74·70
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	7·50
Water	3·00
Silica	72·30
Alumina	10·00
Peroxide of iron	3·50
Carbonate of lime	1·20
Sulphate of lime	2·50
Potash and soda (traces).	
Magnesia (traces).	
	100·00

SOIL No. 9.

This soil lies on the farm of Mr. Collet, in the Vale of Clywd, to the northward of Mount York. It is formed by the disintegrated granitic rocks, conglomerates, and slates, which compose the ridges in the vicinity. Its specific gravity is 2·5; its colour grey. The soil contains large fragments in process of disintegration; the smaller, which, properly speaking, constitute the soil, are coarse; it drains off the water well, and lacks cohesive principles. Its appearance is that of a soil fit for cultivation, under which it produced, according to Mr. Collet, a very good crop of wheat and oats, and this without manure; but, "*from some cause or other*," it became sterile. Mr. Collet's opinion is, that the nature of the soil changed after the drought began to affect the colony (!)

Physical Character.

Power of absorption of solar rays	+ 15
Power of terrestrial radiation	− 6
Capacity for moisture	+ 4

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	5
Insoluble in acids	95
	100
Constituents in 100 parts:—	
Vegetable and animal matter	2·20
Water	2·00
Silica	77·50
Alumina	5·00
Peroxide of iron	5·50
Carbonate of lime	6·00
Magnesia	1·80
	100·00

Soil No. 10.

Represents the average soil which covers Mount Tomah. It is produced by the disintegration of basalt; its specific gravity is 1·6; colour brown; is fine-grained, and unctuous to the touch when moist; when dry it feels gritty; it is permeable, yet retentive of rain-water. The sample is a specimen of the preponderating soil of the locality, which is as yet untouched by the hand of industry. The indigenous vegetation which it alone produces is of the most luxuriant description. The Cryptogamia and the Gramineæ exhibit throughout signs of unparalleled health and vigour. That part of the ridge which is known under the name of Captain Town's farm produces very good crops of wheat, oats, and barley. A well-directed drainage, which that farm is in need of, would bring its fields into a most flourishing condition. Specific gravity 1·6.

Physical Character.

Power of absorption of solar rays	+ 13
Power of terrestrial radiation	— 3
Capacity for moisture	+ 10

Chemical Character.

Solubility of 100 parts:—	
Soluble	37·50
Insoluble	62·50
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	15·00
Water	8·00
Silica	50·50
Alumina	12·00
Peroxide of iron	3·20
Carbonate of lime	8·00
Sulphate of lime (traces).	
Potash	2·30
Chlorides (traces).	
Sulphurets (traces).	
Magnesia (traces).	
Loss	1·00
	100·00

Soil No. 11.

The farm from which this soil was taken belongs to Captain Ryan of Boree. It is situated west of Mount Canoblas. Greenstone, basalt, limestone, and arenaceous conglomerates contributed to the formation of the soil. Its specific gravity is 2·0; its colour a darkish brown. It is rather coarse; the particles are angular and seem to resist a complete disintegration. The soil is permeable, agglutinates tolerably, and is slightly retentive. It was under cultivation for some years, but this was discontinued on account of the repeated failure of the crops. The intelligent farmer, Mr. Keynon, who is overseer of the farm, attributes the failure of the spring crops, by frosts, to some defect in the soil.

Physical Character.

Power of absorption of solar rays	+ 6·0
Power of terrestrial radiation	— 3·5
Capacity for moisture	+ 3·0

Chemical Character.

Solubility of 100 parts : —	
Soluble in acids	9
Insoluble	91
	100
Constituents in 100 parts : —	
Animal and vegetable matter	5·00
Water	1·00
Silica	70·70
Alumina	8·50
Peroxide of iron	4·50
Carbonate of lime	7·20
Potassa and soda	2·00
Chlorides (traces).	
Magnesia (traces).	
Loss	1·10
	100·00

SOIL No. 12.

This soil is from the small farm of Kirigdon Ponds, situated to the westward of Mount Wingen. It is formed by the disintegration of greenstone and arenaceous rocks. Its specific gravity is 2·9; its colour brownish; it contains very few pebbles, and is of an uniformly coarse and gritty composition. It is permeable, yet retentive of rain-water: its cohesion is moderate, and its appearance speaks rather favourably of its fertility. It was formerly under cultivation, and produced, according to the statement of the tenant, good crops of maize and tobacco, for several successive years, without any necessity of manure; but it is now abandoned, having ceased to produce any thing, which the tenant ascribes to a blight that once befell the crops (!)

Physical Character.

Power of absorption of solar rays	+ 10
Power of terrestrial radiation	− 4
Capacity for moisture	+ 2

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	10
Insoluble	90
	100
Constituents in 100 parts: —	
Vegetable and animal matter	3·50
Water	2·50
Silica	70·00
Alumina	10·80
Peroxide of iron	3·50
Carbonate of lime	6·20
Lime, sulphate (traces).	
Magnesia	2·20
Loss	1·30
	100·00

Soil No. 13.

Is a specimen of the soil covering a large portion of the flats of New South Wales. Its specific gravity is high; its colour is creamy; it is very finely granulated; to the touch it feels soft and mealy; in drought, it is raised into a fine dust on the roads; in wet weather, it is slippery and muddy; after rain, it is hard, strongly cohesive, and crusty on the surface. It is never cultivated, and produces a low, scrubby, and stunted vegetation, with scarcely any gramineæ. Specific gravity, 3·50.

Physical Character.

Power of absorption of solar rays	+ 11·8
Power of radiation	— 6·5
Capacity for moisture	+ 2·0

Chemical Character.

Solubility of 100 parts :—	
Soluble in acids	8
Insoluble in acids	92
	100
Constituents in 100 parts :—	
Animal and vegetable matter	4·00
Water	0·50
Silica	87·80
Alumina	6·20
Carbonate of lime	1·50
	100·00

VAN DIEMEN'S LAND.

SOIL No. 14.

This soil belongs to Mona Vale, the property of Mr. Kermode, of which, a few pages back, a cursory description has been given. It is taken from twenty-four different parts of what is called, on that farm, the "Big Swamp," which was originally a lagoon, situated on Blackman's river, and lying on somewhat a lower level than the river itself. This lagoon has been embanked and drained; it is circular in its form, and embraces an area of 470 acres. The entire soil is a decomposed mass of vegetable matter, mixed with drifts of disintegrated greenstone and sandstone, lying eight feet deep, on a bed of yellow clay. Its specific gravity is between 1·00 and 1·18; its colour is black; the division of its particles fine; and its consistence spongy, by reason of the quantity of vegetable fibre it contains. It aggregates easily in large lumps, and, when wet, is cloggy and unctuous; in drought it cracks.

It is not manured, but it is drained and irrigated. It is under meadow, grasses, and turnips, and produces five tons per acre of very fine hay. This soil, according to Mr. Kermode, is too rank and strong for grain; but turnips, rape, and grasses flourish on it surprisingly.

Physical Character.

Power of absorption of solar rays	+ 12·6
Power of terrestrial radiation	— 2·0
Capacity for moisture	+ 18·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	40·30
Insoluble in acids	60·70
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	37·75
Water	24·40
Silica	14·86
Alumina	2·70
Iron (traces).	
Carbonate of lime	10·30
Sulphate of lime	5·70
Potash and soda	2·00
Chlorides (traces).	
Magnesia (traces).	
Loss	2·19
	100·00

SOIL No. 15.

Belongs to the same basin as the former soil; but the site is somewhat more elevated. It forms the south extremity of the basin; and, being within the more direct range of the drift of disintegrated greenstone, it is lighter in colour, and more tenacious of moisture, than No. 14. It is also more gritty.

Physical Character.

Power of absorption of solar rays	+ 14·2
Power of terrestrial radiation	— 0·5
Capacity for moisture	+ 17·6

Chemical Character.

Solubility of 100 parts :—	
Soluble in acids	38·10
Insoluble in acids	69·90
	100·00
Constituents in 100 parts :—	
Animal and vegetable matter	34·05
Water	22·80
Silica	19·54
Alumina	8·32
Peroxide of iron	3·50
Carbonate of lime	1·50
Sulphate of lime	2·80
Potash and soda (traces).	
Chlorides (traces).	
Oxides and sulphurets	5·70
Magnesia (traces).	
Loss	1·79
	100·00

Soil No. 16.

This soil belongs likewise to the farm of Mona Vale. It is taken from a plain, of which the adjacent hills are greenstone, and is partly an alluvium. The plain is undulating, and is more subjected to alternate denudation and renovation, than to steady accumulation of drift. Its specific gravity is 1·70; its colour a blackish grey; its consistence coarse. It aggregates easily in lumps of some tenacity, resisting the pressure of the fingers, and feeling gritty when crushed. Its permeability is not very great; in a heavy rain it resists the percolation, and in drought it cracks. It is easy of cultivation, although it clogs when moist;

is neither manured nor irrigated; was formerly under wheat, but yielded such unprofitable crops, and so frequently suffered from frost, that its cultivation was abandoned. Its subsoil is clay and diluvium. Mr. Kermode looks upon this soil as the least productive soil upon the farm, notwithstanding its external appearance, which is promising.

Physical Character.

Power of absorption of solar rays	+ 9
Power of terrestrial radiation	— 4
Capacity for moisture	+ 8

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	11
Insoluble in acids	89
	100
Constituents in 100 parts: —	
Vegetable and animal matter	9·70
Water	8·00
Silica	44·91
Alumina	6·70
Subsulphate of the sesquinoxide of iron	27·69
Sulphate of lime	1·70
Loss	1·30
	100·00

Soil No. 17.

Is the fourth soil taken from the farm of Mr. Kermode. It lies in the vicinity of the preceding, and partakes somewhat of its character, but on closer examination is nevertheless found to differ. It has all the appearance of an excellent soil for cultivation, yet every crop has failed upon it. Its specific gravity is 1·30; colour, a greyish brown; is more permeable than the preceding soil, and does not clog so much when moist. It has been neither manured nor irrigated. Its subsoil is clay and diluvium. It is pronounced by Mr. Kermode as dry, cold, sour, and subjecting the crops to frost.

Physical Character.

Power of absorption of solar rays	+ 9·8
Power of terrestrial radiation	— 45·0
Capacity for moisture	+ 6·66

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	9·50
Insoluble in acids	90·50
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	10·60
Water	12·80
Silica	46·47
Alumina	15·37
Dipersulphate of the peroxide of iron	14·76
Chlorides (traces).	
Magnesia (traces).	
	100·00

Soil No. 18.

This soil is taken from Brickendon, an estate belonging to William Archer, Esq., of Norfolk Plains, situated in the most advantageous position for effecting improvements in agriculture, and, from those which have already taken place, entitled to be classed among the best of the Australian settlements. Its fields, in general, are slightly inclined, and within the range of high greenstone mountains. They are obviously composed of rich alluvium and the disintegration of the above hills. Their present position is, however, such, that they are neither exposed to denudation nor to further accumulation. The sample of soil was taken from one of the largest fields; its specific gravity is 2·20; colour a darkish brown; cohesion moderate; and it feels soft to the touch. Its permeability secures to it all the benefit of rain: thus, it resists well the drought; yet, though upon a level ground, it is not swampy. When worked, it requires a strong team. It has been manured, but not irrigated; it produces of wheat 35 bushels per acre, for 1½ of seed; it is fallowed, and receives wheat every three years. The subsoil is gravel and clay. Mr. Archer looks upon this soil as possessing the highest productive power.

Physical Character.

Power of absorption of solar rays	+ 12
Power of terrestrial radiation	− 3
Capacity for moisture	+ 4

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	32·80
Insoluble in acids	67·20
	100·00
Constituents in 100 parts:—	
Vegetable and animal matter	11·00
Water	6·00
Silica	56·50
Alumina	10·10
Peroxide of iron	4·50
Carbonate of lime	2·10
Sulphate of lime	4·80
Potash and soda	1·50
Chlorides (traces).	
Sulphurets and oxides (traces).	
Magnesia	1·50
Loss	2·00
	100·00

SOIL No. 19.

From the same farm as the preceding, but situated somewhat higher, and more on an inclined plane.

Its specific gravity lies between 2·50 and 3·00. It is a light brown soil of a fine texture, rather loosely cohering; feels gritty when rubbed between the fingers; is porous, and subject to denudation and renovation of the surface; was never manured nor irrigated. Wheat, barley, and oats have been tried with little success. The crops failed, and the field has been abandoned. Mr. Archer pronounces it to be the soil of the least productive power upon the farm, and subject to frost. It rests on a bed of brown clay.

Physical Character.

Power of absorption of solar rays	+	15·00
Power of terrestrial radiation	—	8·04
Capacity for moisture	+	3·05

Chemical Character.

Solubility of 100 parts : —	
Soluble in acids	7·50
Insoluble in acids	92·50
	100·00
Constituents in 100 parts : —	
Animal and vegetable matter	8·00
Water	5·00
Silica	69·00
Alumina	10·20
Peroxide of iron	1·00
Carbonate of lime	2·00
Potash and soda	1·30
Magnesia	2·00
Loss	1·50
	100·00

SOIL No. 20.

Is the soil immediately adjoining the south part of Longford, Norfolk Plains, on the banks of the Lake river. It is alluvial; its specific gravity is 3·27; its colour a blackish brown; it is finely grained and moderately cohesive, resisting equally well the effects of drought and heavy rain. It is neither manured nor irrigated. This soil is pronounced to be of the highest productive power. It yielded forty bushels per acre, and has yielded ninety of Cape barley; but the crop is considered peculiarly precarious, being more subject to injury from frost than on any of the adjoining lands.

Physical Character.

Power of absorption of solar rays	+ 12·0
Power of terrestrial radiation	— 6·5
Capacity for moisture	+ 5·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	29·50
Insoluble in acids	70·50
	100·00
Constituents in 100 parts:—	
Vegetable matter	7·49
Water	10·00
Silica	55·00
Alumina	10·00
Peroxide of iron	5·25
Carbonate of lime	5·26
Potash	2·00
Sulphate of lime	0·70
Magnesia	2·10
Loss	2·20
	100·00

SOIL No. 21.

From the farm of the Van Diemen's Land Company, called Circular Head. The arable ground is isolated from all hills: it stands on a neck of land jutting out into the sea, and rests upon greenstone, trachyte, and greywacke, from the disintegration of which it takes its origin. The whole extent of the cultivated fields is most systematically divided and laid out, and presents, together with the farm buildings, the residence and gardens of the commissioners, an entirely English aspect. The sample of soil was taken from a field of the highest productive power: its specific gravity is 1·95; its colour of a reddish brown. It is fine grained, of moderate cohesion, and friable; unctuous to the touch, porous, and easily dries up. It does not crack during drought, neither does it clog when wet. It is manured: the principal crop it produces is wheat, of which forty bushels is the average return. The rotation of this field is two crops of turnips, and then a fine crop of wheat.

Physical Character.

Power of absorption of solar rays	+ 14·0
Power of terrestrial radiation	— 3·5
Capacity for moisture	+ 9·0

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	35·10
Insoluble	64.90
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	9·28
Water	10·00
Silica	51·52
Alumina	9·00
Peroxide of iron	5·10
Carbonate of lime	5·40
Sulphate of lime	5·50
Potash and soda	1·10
Chlorides (traces).	
Magnesia	2·00
Loss	1·10
	100·00

Soil No. 22.

Belongs to the same farm as No. 21. The soil from which the sample was obtained is situated lower down.

It is a marshy soil, and, notwithstanding its apparently inferior quality, possesses a high productive power. Its specific gravity is 2·70; its colour light brown; its substance fine-grained and unctuous. It feels dry to the touch; is extremely porous, owing to the vegetable fibre it contains being easily saturated, and becoming quickly dry again. It is not manured nor irrigated, and is now under meadow grass, but yielded forty tons of turnips previously.

Physical Character.

Power of absorption of solar rays	+ 24·70
Power of terrestrial radiation	— 7·00
Capacity for moisture	+ 13·00

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	30·00
Insoluble	70·00
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	18·93
Water	8·50
Silica	49·17
Alumina	5·90
Peroxide of iron	3·10
Carbonate of lime	4·20
Sulphate of lime	2·80
Potash and soda	1·80
Chlorides (traces).	
Sulphurets (traces).	
Magnesia	3·10
Loss	2·50
	100·00

SOIL No. 23.

From the same farm as the two preceding soils, but taken from the heathy plains which surround the farm to the southward. It is of the lowest productive power: its specific gravity is 6·09; being heavier whence the sample of soil is taken is of the highest productive power. It yields thirty bushels of wheat per acre, and takes about two of seed; is alternated with crops of wheat and barley, and has been under cultivation six years. It suffers from frost; and was never manured, fallowed, or irrigated. Its subsoil is clay; specific gravity 2·77; colour a blackish grey; texture pretty fine, but uneven; the grains are angular; the cohesion moderate, and the permeability great; the water drains away easily; and the land suffers from drought. Its cultivation requires little labour or expense.

Physical Character.

Power of absorption of solar rays	+ 26·00
Power of terrestrial radiation	− 16·00
Capacity for moisture	+ 2·94

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	22·00
Insoluble	78·00
	100·00
Constituents in 100 parts: —	
Vegetable and animal matter	2·16
Water	1·00
Silica	64·00
Alumina	10·00
Peroxide of iron	2·50
Carbonate of lime	15·00
Potash and soda	0·74
Magnesia	2·20
Loss	2·40
	100·00

Soil No. 26.

The soil belongs, like that which preceded it, to the farm of Malachite. In a geological point of view, it is similarly situated; but being upon a more inclined plane, and cut off by the adjacent ravines from communication with the greenstone hills, it is more subject to denudation than to accumulation. The field from which the soil was taken is looked upon as possessing the lowest productive power, and it is subject, like the previous soil, to frost. Turnips, potatoes, and carrots have been cultivated upon it, but with little success. Its specific gravity is 2·80; its colour is a light grey; its substance is fine, but loose and uncohesive, like a sandy soil, dry and gritty to the touch, and very permeable. Under water it does not agglutinate. It has been neither manured, irrigated, nor fallowed: its subsoil is the gravel of a diluvium.

Physical Character.

Power of absorption of solar rays - -	+ 26
Power of terrestrial radiation - -	− 14
Capacity for moisture - - -	+ 1

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids - - - -	8·50
Insoluble in acids - - - -	91·50
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter - - -	5·40
Water - - - - -	4·00
Silica - - - - -	65·66
Alumina - - - - -	16·00
Peroxide of iron - - - -	1·00
Carbonate of lime - - - -	4·54
Potash and soda - - - -	1·20
Magnesia - - - - -	2·20
	100·00

Soil No. 27.

This soil is from Quamby, a farm the property of Richard Dry, Esq., situated at the outlet of the Tamar valley, and 25,000 acres in extent. It is throughout undulating, and the river Meander waters the greatest portion of it. The soil is partly alluvial, partly diluvial, and the estate every where shows great fertility and capability of improvement, especially owing to its position with regard to the adjacent greenstone hills, from which it derives the most valuable fertilising ingredients, and to the river Meander, by which the greatest portion of the property may be irrigated. The field whence the soil is taken represents the character of a great portion of the estate. It is thought by the farmer to be of the highest productive power, yielding forty bushels per acre in return for 1½ of wheat sown. It was never irrigated, fallowed, or manured; neither has it been under regular rotation. Between five crops of wheat, two only, of oats, intervened. Its subsoil is a red clay: its specific gravity 1·79; its colour a very deep brown; its substance tolerably fine, aggregating easily, and being rather gritty to the touch. It is porous, but retentive of water; and to be cultivated requires a strong team, both in dry and wet weather.

Physical Character.

Power of absorption of solar rays	+ 10·5
Power of terrestrial radiation	— 0·4
Capacity for moisture	+ 6·1

Chemical Character.

Solubility of 100 parts:—

Soluble in acids	26·50
Insoluble in acids	73·50
	100·00

Constituents in 100 parts:—

Animal and vegetable matter	10·60
Water	5·50
Silica	61·80
Alumina	10·20
Peroxide of iron	2·50
Carbonate of lime	5·50
Sulphate of lime	1·50
Magnesia	1·30
Loss	1·10
	100·00

SOIL No. 28.

Belongs likewise to Quamby's farm. In its appearance it differs from the preceding soil only in being of a lighter brown colour. In the character, however, given of it by the farmer, the difference is material; it being of the lowest productive power, and very much subjected to frost. It is called sour, cold, and moist; but no means of improving it have been tried: the fact of its never having returned a good crop has caused it to be abandoned. Its specific gravity is 2·54; its colour brown; its texture is of moderate fineness; it aggregates easily when wet, and becomes stiff; feels gritty, and is permeable, but does not drain the water off easily. It is rather heavy to work when moist.

Physical Character.

Power of absorption of solar rays	+ 14·9
Power of terrestrial radiation	— 6·0
Capacity for moisture	+ 7·0

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	10·50
Insoluble in acids	89·50
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	4·00
Water	3·00
Silica	80·29
Alumina	5·70
Peroxide of iron	0·21
Carbonate of lime	4·80
Magnesia	2·00
	100·00

SOIL No. 29.

As illustrating the effects of denudation, the district of Bothwell was particularly pointed out, exhibiting, as it does, in many instances, soils apparently most fertile, but which, through denudation and renovation of the surface, whereby the protoxide of iron in which they abound has been exposed to continual conversion into peroxide, produce no vegetation. The farm of Logan, the property of Mr. A. M‘Dowell, to which the Soil No. 29. refers, is situated in this district. The soil was taken from a field representing the average character of the best soils under cultivation in the district; those, namely, which are the least subjected to the effects of denudation, either from the small quantity of iron they contain, or from the slight degree of inclination in their surface. This soil produces twenty bushels of wheat for 1½ of seed, and is alternated with English grasses and turnips, which are fed off by sheep hurdled on the field: it is not irrigated, nor manured. Its specific gravity is 2·61; its colour, a dark greyish brown; its particles are fine, and rather loose and gritty. It is porous, and which causes it to suffer from drought and frost.

Physical Character.

Power of absorption of solar rays	+	11·8
Power of terrestrial radiation	—	4·0
Capacity for moisture	+	2·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	25·30
Insoluble in acids	74·70
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	3·60
Water	1·50
Silica	76·00
Alumina	5·20
Peroxide of iron	4·35
Carbonate of lime	5·65
Magnesia	1·90
Loss	1·80
	100·00

Soil No. 30.

This soil is from the above farm of Logan, but it represents the soils of the least productive power in the district. Specific gravity 2·08; colour, a light grey; particles fine, and of moderate cohesion, becoming, in drought, an impalpable powder, and during the rainy season somewhat muddy. It feels gritty to the touch, and has been neither manured nor fallowed. Every crop has failed.

Physical Character.

Power of absorption of solar rays	+ 15·4
Power of terrestrial radiation	— 8·0
Capacity for moisture	+ 2·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	7·50
Insoluble in acids	92·50
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	3·65
Water	1·00
Silica	74·25
Alumina	17·10
Peroxide of iron	1·20
Carbonate of lime	2·50
Magnesia	0·30
	100·00

Soil No. 31.

The farm from which the above soil was taken is called Glen-Leith, and is the property of D. Jamieson, Esq. From its favourable position on the river Plenty, and from the improvements which have taken place on it already, it deserves to be mentioned as one of the best farms in the Derwent valley. The soil was taken from a field which had been under cultivation about eighteen years. The first five crops of wheat produced, from a bushel and a half of seed, 35 to 40 bushels per acre. It was then laid down in grasses, open both to sheep and cattle, for six years; and, when broken up again, the return of wheat was not more than from 25 to 30 bushels. It has since twice grown turnips, which have been fed off with sheep; *but it never returned a crop equal to the first five.* Its specific gravity is 1·99; its colour, a fine dark brown. Its particles are tolerably fine, readily adhere, and are gritty to the touch. It is permeable, retains the water, and when moist is difficult to cultivate.

Physical Character.

Power of absorption of solar rays	+ 14·0
Power of terrestrial radiation	— 1·5
Capacity for moisture	+ 6·0

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	22·00
Insoluble in acids	78·00
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	11·50
Water	5·20
Silica	66·65
Alumina	5·30
Peroxide of iron	3·20
Carbonate of lime	3·80
Sulphate of lime	0·80
Potash and soda (traces).	
Sulphurets and oxides	2·80
Magnesia (traces).	
Loss	0·75
	100·00

SOIL No. 32.

Belongs to the same farm as the preceding soil. It was taken from a field first broken up fourteen years ago, and which for five succeeding years produced upwards of 40 bushels of wheat per acre. This high power of production gradually decreased: the field was then sown with turnips, which were fed off with sheep, but the wheat afterwards raised did not average 18 bushels. The irrigation, which was next brought upon it, to use the expression of Mr. Jamieson, worked wonders, as the produce of wheat the next year reached 25 bushels per acre. Specific gravity 2·00; colour a blackish grey; substance fine, with numerous angular fragments of middling size. It agglutinates easily, drains off the surface-water quickly, and retains it beneath. It is easier worked than the preceding soil.

Physical Character.

Power of absorption of solar rays	+ 19
Power of terrestrial radiation	— 2
Capacity for moisture	+ 8

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	25·40
Insoluble in acids	74·60
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	9·50
Water	4·00
Silica	70·90
Alumina	6·90
Peroxide of iron	2·10
Carbonate of lime	2·90
Sulphate of lime	2·50
Potash and soda (traces).	
Chlorides (traces).	
Sulphurets	1·20
	100·00

Soil No. 33.

From an estate of Mr. Whittle, the farthest station on the North Esk. The soil of this farm is formed from the detritus of greenstone and coarse sandstone, which contain a considerable quantity of protoxide of iron. That which the above sample represents is situated on the slope of a hill, containing both kinds of rock. Its specific gravity is 2·2; its colour reddish; substance rather coarse grained, one half consisting of fine siliceous and clayey particles. It has little cohesion; and from its position, on the side of the hill, is exposed to denudation, through those heavy rains which frequently fall in the vicinity of Ben Lomond and Ben Nevis. It is consequently subject to a continual process of conversion of the protoxide into peroxide, which renders the soil ill adapted to cereales. Thus, notwithstanding its promising external character, all the crops have failed on it. A similar soil, in a paddock lower down, not exposed to denudation, yields to Mr. Whittle most beautiful crops of turnips, barley, and wheat.

Physical Character.

Power of absorption of solar rays	+ 18·0
Power of terrestrial radiation	— 4·5
Capacity for moisture	+ 7·0

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	18·00
Insoluble in acids	82·00
	100·00
Constituents in 100 parts: —	
Vegetable and animal matter	5·20
Water	3·10
Silica	57·90
Alumina	12·00
Peroxide of iron	9·00
Carbonate of lime	10·00
Potash and soda	1·00
Loss	1·80
	100·00

Soil No. 34.

This soil belongs to the basin south of Launceston, which is occupied by Franklin village. It is situated amid ridges of greenstone, which yielded their ingredients for its formation. Its specific gravity is 1·9; its colour, a dark brown. Its consistency unites the qualities of permeability and retentiveness; its appearance denotes fertility. The tenant has, however, abandoned it, on account of its sterility. It is true, he says, that it yielded, some years back, good crops of wheat; but since the last drought it has produced nothing.

Physical Character.

Power of absorption of solar rays	+ 20·0
Power of terrestrial radiation	− 8·0
Capacity for moisture	+ 4·0

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	10·20
Insoluble in acids	89·80
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	7·20
Water	3·10
Silica	70·00
Alumina	11·20
Peroxide of iron	3·50
Carbonate of lime	2·10
Potash and soda	1·80
Magnesia	1·10
	100·00

Soil No. 35.

This soil belongs to a farm called Point Effingham, situated on the left bank of the river Tamar. It is formed from the disintegration of coarse greenstone and arenaceous rocks. Its position exposes it to denudation, and it thus contains but coarser elements of the pre-existing rocks. The specific gravity of this soil is 3·2; its colour brown, substance coarse, and cohesion moderate. It is permeable, and but slightly retentive of water. Its external appearance indicates fertility. It was cultivated for several years without manure, but was abandoned, as the crops of wheat, oats, and potatoes generally failed. Mr. Lawrence, the proprietor of the farm, ascribed this failure partly to the frost, partly to the low productive power.

Physical Character.

Power of absorption of solar rays	+ 10
Power of terrestrial radiation	− 4
Capacity for moisture	+ 3

Chemical Character.

Solubility of 100 parts :—	
Soluble in acids	5·00
Insoluble in acids	95·00
	100·00
Constituents in 100 parts : —	
Animal and vegetable matter	8·00
Water	4·00
Silica	72·40
Alumina	9·10
Peroxide of iron	1·20
Carbonate of lime	3·50
Magnesia	1·80
	100·00

SOIL No. 36.

Is a sample of a soil composing a large tract of the northern littoral of Van Diemen's Land, east of Tamar river. It was taken from a farm of Mr. Nowland's, on the river Piper. Greenstone, greywacke, and granitic rocks, each contributed their share towards the formation of this soil. Its specific gravity is 2·5; colour, reddish; and substance uneven. It contains pebbles of different sizes, embedded in a finely comminuted earth. It is thus both permeable and retentive of water. It was formerly under cultivation without manure. The farmer tried, first wheat, then barley, oats, and potatoes; every crop failed, more or less; upon which the land, though apparently promising, was abandoned.

Physical Character.

Power of absorption of solar rays	+ 15
Power of terrestrial radiation	− 5
Capacity for moisture	+ 3

Chemical Character.

Solubility of 100 parts : —	
Soluble in acids	4·50
Insoluble in acids	95·50
	100·00
Constituents in 100 parts : —	
Vegetable and animal matter	4·00
Water	3·00
Silica	68·00
Alumina	10·20
Peroxide of iron	2·10
Carbonate of lime	10·90
Magnesia	1·80
	100·00

Soil No. 37.

Belonging to a Cape Portland farm, which is in the hands of an intelligent and industrious tenant, of the name of Bowen. The soils of the farm are formed from the disintegration of gneiss and eurite, and generally produce good crops of wheat and potatoes. The soil, however, which is under consideration, though identical with the rest, produces nothing. Its specific gravity is 2·5; its colour is dark grey; it is gritty, contains very little fine-grained earthy matter, and is but slightly cohesive, being of a gravelly character. From its inclined position, and want of agglutinating principles, it is liable to denudation, through which all the valuable particles derived from the disintegration of felspathic minerals are carried away.

Physical Character.

Power of absorption of solar heat	+ 10
Power of terrestrial radiation	— 4
Capacity for moisture	+ 3

Chemical Character.

Solubility of 100 parts : —	
Soluble in acids	10·00
Insoluble in acids	90·00
	100·00
Constituents in 100 parts : —	
Animal and vegetable matter	2·50
Water	1·50
Silica	70·50
Alumina	8·10
Peroxide of iron	4·50
Carbonate of lime	9·00
Potash and soda	1·70
Loss	1·20
	100·00

SOIL No. 38.

Was taken from a farm on St. George's or St. Helen's river, belonging to the Honourable Mr. Talbot, and in the hands of a tenant. Granitic rocks and greenstones yielded their ingredients to the formation of the soil. Its specific gravity is 2·0; colour brown, and texture coarse. A third part of it consists of pebbles of quartz and flint; it has little cohesion, great permeability, and does not sufficiently retain water. The tenant tried wheat, oats, and potatoes, but every crop failed; so the soil was abandoned to weeds and rushes. It was never manured.

Physical Character.

Power of absorption of solar rays	+ 12
Power of terrestrial radiation	— 5
Capacity for moisture	+ 3

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	6·00
Insoluble in acids	94·00
	100·00
Constituents in 100 parts: —	
Animal and vegetable matter	4·00
Water	3·05
Silica	82·70
Alumina	7·20
Peroxide of iron	1·10
Carbonate of lime	1·50
Loss	0·45
	100·00

Soil No. 39.

Belongs to the upper country of Van Diemen's Land, commonly called the Lake country. It lays among trap rocks, and may be said to be entirely composed of disintegrated greenstone, basalt, and trachyte. Its specific gravity is 1·5; colour, a blackish brown; cohesion moderate; is rather gritty to the touch; clogs when wet, and resists drought, as it quickly absorbs water. It is as yet untouched by the hand of man, and produces a luxuriant indigenous vegetation of grass, shrubs, and trees. This soil represents the soils of a large tract of country belonging to the Government, and needing only draining and population to be converted into a most productive district of the island. Specific gravity, 1·0.

Physical Character.

Power of absorption of solar rays	+ 12·0
Power of terrestrial radiation	— 3·0
Capacity for moisture	+ 12·0

Chemical Character.

Solubility of 100 parts: —	
Soluble in acids	38·50
Insoluble in acids	61·50
	100·00
Constituents in 100 parts: —	
Vegetable matter	20·10
Water	10·10
Silica	37·00
Alumina	6·50
Peroxide of iron	3·30
Carbonate of lime	6·20
Sulphate (traces).	
Potash and soda	1·90
Chlorides (traces).	
Sulphurets	1·20
Magnesia	1·50
Loss	2·20
	100·00

Soil No. 40.

Represents the soils which cover the western shores of the river Huyon. The sample refers more particularly to a property of 4000 acres, sold by William Price, Esq., to Lady Franklin, and which, subdivided in allotments of 100 and 200 acres, is, through the wonted liberality of her Ladyship, resold to small farmers of good character, at a prime cost of 12*s*. an acre. This sample is an average of as yet untouched ground. The soil of the whole Huyon valley is derived from the disintegration of greenstone, trachyte, and greywacke. Its specific gravity is 1·3; its colour is a darkish brown; its substance tolerably fine. It feels gritty, easily agglutinates, and is both permeable and retentive of moisture. It produces the most beautiful and valuable timber in the island, the trees exceeding 200 feet in height, and sometimes measuring in circumference thirty-six feet. Crops of wheat and potatoes succeed surprisingly. Those among the small settlers who industriously availed themselves of the productiveness of this soil, realised in one year, by the timber and potatoes alone, the prime cost which they paid for the land. Specific gravity, 1·3.

Physical Character.

Power of absorption of solar rays	+ 16·00
Power of terrestrial radiation	— 2·00
Capacity for moisture	+ 9·00

Chemical Character.

Solubility of 100 parts : —	
Soluble in acids	41·20
Insoluble in acids	58·80
	100·00
Constituents in 100 parts : —	
Animal and vegetable matter	18·00
Water	7·50
Silica	52·60
Alumina	10·00
Peroxide of iron	2·10
Carbonate of lime	7·00
Sulphate of lime (traces).	
Potash and soda	1·20
Chlorides (traces).	
Sulphurets	1·50
	100·00

Soil No. 41.

Taken from one of the small farms of Delarcyne dictrict, which is famous for its fertile soils, derived from the disintegration of greenstone and quartz rock. The one under consideration has a specific gravity of 3·2; it is dark grey in colour, of pretty even substance; gritty when dry, rather smooth when moist; it absorbs and retains equally well the rain-water. Its appearance is good. It was cultivated without manure, and used to yield good crops of wheat for several years, but it was finally abandoned on account of sterility, brought on, as the tenant acknowledges, by continual crops of maize, which he raised without manure.

Physical Character.

Power of absorption of solar rays	+ 18
Power of terrestrial radiation	— 7
Capacity for moisture	+ 2

Chemical Character.

Solubility of 100 parts:—	
Soluble in acids	7·00
Insoluble	93·00
	100·00
Constituents in 100 parts:—	
Animal and vegetable matter	6·50
Water	2·30
Silica	68·10
Alumina	10·00
Peroxide of iron	4·20
Carbonate of lime	6·10
Potash and soda	0·50
Magnesia	1·20
Loss	1·10
	100·00

The following tabular views represent the preceding analyses of soils in two distinct groups, — one of the highest, the other of the lowest productive power obtained:—

I.—TABLE OF AUSTRALIAN SOILS OF THE HIGHEST PRODUCTIVE POWER.

Number to which the Soil refers.	PHYSICAL CHARACTER.				CHEMICAL CHARACTER OF THE SOILS.												
						Proximate Constituents in 100 Parts.											
											LIME.						
	Absorption of Solar Rays.	Emission of Heat.	Capacity for Moisture.	Specific Gravity.	Soluble Portion of 100 Parts.	Vegetable and Animal Matter.	Water.	Silica.	Alumina.	Peroxide of Iron.	Carbonate.	Sulphate.	Potash and Soda.	Chlorides.	Magnesia.	Metallic Sulphurets and Oxides.	Loss.
No. 1	+ 14·0	− 1·0	+ 6·0	1·9	19·74	18·44	6·53	56·63	10·15	4·00	2·70	1·20	—	—	Traces.	—	0·35
No. 2	+ 11·0	− 2·5	+ 7·0	2·2	33·07	15·60	5·50	59·80	9·00	1·90	2·00	4·70	1·50	—	Traces.	—	—
No. 3	+ 7·0	− 2·0	+ 8·0	2·0	26·51	7·30	4·00	65·73	12·42	3·75	6·20	0·60	Traces.	—	—	—	—
No. 4	Subsoil not taken.				23·26	8·10	3·00	65·40	8·90	4·50	6·50	2·25	Traces.	—	1·10	—	—
No. 5	+ 12·0	− 4·0	+ 5·0	3·0	25·75	9·00	4·00	63·00	15·00	4·00	3·20	0·80	—	—	1·00	—	—
No. 6	+ 11·7	− 3·0	+ 7·0	2·2	30·30	10·00	5·20	53·70	19·20	3·20	2·50	4·20	0·80	—	1·20	—	—
No. 8	+ 14·0	− 2·5	+ 6·0	1·8	25·30	7·50	3·00	72·30	10·00	3·50	1·20	2·50	Traces.	—	Traces.	—	—
No. 10	+ 12·6	− 2·0	+ 18·0	1·1	40·30	37·75	24·40	14·86	2·75	Traces.	10·30	5·70	2·00	Traces.	Traces.	—	2·19
No. 14	+ 14·2	− 0·5	+ 17·0	1·0	38·10	34·05	22·80	19·54	8·32	3·50	1·50	2·80	Traces.	Traces.	Traces.	5·70	1·79
No. 15	+ 12·0	− 3·0	+ 4·0	2·0	32·80	11·00	6·00	56·50	10·10	4·50	2·10	4·80	1·50	Traces.	1·50	Traces.	2·00
No. 18	+ 14·0	− 3·5	+ 9·0	1·9	35·10	9·28	10·00	51·52	9·00	5·10	5·40	5·50	1·10	Traces.	2·00	—	1·10
No. 21	+ 24·7	− 7·0	+ 13·0	2·7	30·00	18·93	8·50	49·17	5·90	3·10	4·20	2·80	1·80	Traces.	3·10	Traces.	2·50
No. 22	+ 21·0	− 6·0	+ 3·0	2·2	25·20	8·50	6·60	54·50	15·10	3·10	8·10	1·40	—	—	1·50	1·20	—
No. 24	+ 10·5	− 0·4	+ 6·1	1·7	26·50	10·60	5·50	61·80	10·20	2·50	5·50	1·50	—	—	1·30	—	1·10
No. 27	+ 14·0	− 1·5	+ 6·0	1·9	22·00	11·50	5·20	66·65	5·30	3·20	3·80	0·80	Traces.	—	Traces.	2·80	0·75
No. 31	+ 19·0	− 2·0	+ 8·0	2·0	25·40	9·50	4·00	70·90	6·90	2·10	2·90	2·50	Traces.	Traces.	Traces.	1·20	—
No. 32	+ 15·0	− 3·0	+ 12·0	1·0	38·50	20·10	10·10	37·00	6·50	3·30	6·20	Traces.	1·90	Traces.	1·50	1·20	2·20
No. 39	+ 16·0	− 2·0	+ 9·0	1·3	41·20	18·00	7·50	52·60	10·00	2·10	7·10	Traces.	1·20	Traces.	1·50	Traces.	—
No. 40	+ 13·0	− 3·0	+ 10·0	1·6	37·50	15·00	8 00	50·50	12·00	3·20	8·00	Traces.	2·30	Traces.	Traces.	Traces.	1·00
Mean.	+ 13·4	− 2·5	+ 8·0	1·8	30·23	14·70	7·88	54·32	9·82	3·18	4·74	2·33	0·74	—	0·82	0·63	0·84

II.—TABLE OF THE AUSTRALIAN SOILS OF THE LOWEST PRODUCTIVE POWER.

Number to which the Soil refers.	PHYSICAL CHARACTER.				CHEMICAL CHARACTER OF THE SOILS.												
						Constituents in 100 Parts.											
	Absorption of Solar Rays.	Emission of Terrestrial Heat.	Capacity for Moisture.	Specific Gravity.	Soluble Portion of 100 Parts.	Vegetable and Animal Matter.	Water.	Silica.	Alumina.	Peroxide of Iron.	LIME.		Potash and Soda.	Chlorides.	Magnesia.	Sulphurets and Metallic Oxides.	Loss.
											Carbonate.	Sulphate.					
No. 7	+ 6·00	− 3·5	+ 2·0	1·40	10·00	6·80	2·00	70·10	16·20	0·20	2·50	—	—	—	0·20	—	2·00
No. 9	+ 15·00	− 6·0	+ 4·0	2·50	5·00	2·20	2·00	77·50	5·00	5·50	6·00	—	—	—	1·80	—	—
No. 11	+ 6·00	− 3·5	+ 3·0	2·10	9·00	5·00	1·00	70·70	8·50	4·50	7·20	—	2·00	Traces.	Traces.	—	1·10
No. 12	+ 10·00	− 4·0	+ 2·0	1·90	10·00	3·50	2·50	70·00	10·80	3·50	6·20	Traces.	—	—	2·20	—	1·30
No. 13	+ 11·80	− 6·5	+ 2·0	3·50	8·00	4·00	0·50	87·80	6·20	—	1·50	—	—	—	—	—	—
No. 16	+ 9·00	− 4·0	+ 8·0	1·70	11·00	9·70	8·00	44·91	6·70	27·69	—	1·70	1·30	Traces.	Traces.	—	—
No. 17	+ 9·80	− 4·5	+ 6·6	1·30	9·50	10·60	12·80	46·47	15·37	14·76	—	—	—	Traces.	Traces.	—	—
No. 19	+ 15·00	− 8·0	+ 3·5	2·50	7·50	8·00	5·00	69·00	10·20	1·00	2·00	—	1·30	—	2·00	—	1·50
No. 23	+ 27·50	− 12·0	+ 4·0	6·09	5·50	4·33	8·00	82·77	4·90	—	—	—	Traces.	—	—	—	—
No. 26	+ 26·00	− 14·0	+ 1·0	2·80	8·50	5·40	4·00	65·66	16·00	1·00	4·54	—	1·20	—	2·20	—	—
No. 28	+ 14·90	− 6·0	+ 7·0	2·50	10·50	4·00	3·00	80·29	5·70	0·21	4·80	—	—	—	2·00	—	—
No. 30	+ 15·40	− 8·0	+ 2·0	2·00	7·50	3·65	1·00	74·25	17·10	1·20	2·50	—	—	—	0·30	—	—
No. 41	+ 18·70	− 7·0	+ 2·0	3·20	7·00	6·50	2·30	68·10	10·00	4·20	6·10	—	0·50	—	1·20	—	1·10
No. 33	+ 18·00	− 4·5	+ 7·0	2·00	18·00	5·20	3·10	57·90	12·00	9·00	10·00	—	1·00	—	—	—	1·80
No. 34	+ 20·00	− 8·0	+ 4·0	1·90	10·20	7·20	3·10	70·00	11·20	3·50	2·10	—	1·80	—	1·10	—	—
No. 35	+ 10·00	− 4·0	+ 3·0	3·20	5·00	8·00	4·00	72·40	9·10	1·20	3·50	—	—	—	1·80	—	—
No. 36	+ 15·00	− 5·0	+ 3·0	2·50	4·50	4·00	3·00	68·00	10·20	2·10	10·90	—	—	—	1·80	—	—
No. 37	+ 10·00	− 4·0	+ 3·0	2·50	10·00	2·50	1·50	71·50	8·10	4·50	9·00	—	1·70	—	—	—	1·20
No. 38	+ 12·00	− 5·0	+ 3·0	2·00	6·00	4·00	3·05	82·70	7·20	1·10	1·50	—	—	—	—	—	0·45
Mean.	+ 14·21	− 6·1	+ 3·6	2·04	8·53	5·50	3·71	69·99	10·02	4·48	4·12	0·08	0·56	—	0·87	—	0·67

The facts which the two preceding tables furnish, bearing on the question of the productiveness of soils, are,—

1st. That both kinds of soils, that is the fertile and the sterile, aborb, on an average, nearly the same amount of solar heat, but that they differ in their respective power of terrestrial radiation: the fertile soil emits, through radiation, an amount which is two thirds less than that yielded by the sterile soil.

2ndly. That their respective capacities for absorbing atmospheric moisture are different also; the fertile soil absorbing more than double the quantity absorbed by the sterile soil.

3dly. That their solubility in hydrochloric acid is not equal; the fertile soil containing, in 100 parts, 30 parts of soluble matter, while the sterile soils contain but 8 per cent.

4thly. That the difference in the amount of vegetable and animal matter, in the two kinds of soils, is likewise great; the fertile possessing nearly three times as much of these ingredients as the sterile.

5thly. That the mineral constituents of each kind of soil, considered apart from the vegetable matter, the hygrometric water, and the loss in the analysis, and expressed in their atomic weight, are, in the

High Productive Soils.

			The Atomic Weight.	Proportion between the Numbers.
Silica	70·93	=	0·122	30
Alumina	12·84	=	0·020	5
Peroxide of iron	4·15	=	0·004	1
Carbonate of lime	6·25	=	0·020	5
Sulphate of lime	3·04	=	0·007	1
Potash and soda	0·95			
Magnesia	1·00			
Metallic oxides	0·87			

Low Productive Soils.

			The Atomic Weight.	Proportion between the Numbers.
Silica	77·70	=	0·132	26
Alumina	11·11	=	0·017	3
Peroxide of iron	4·94	=	0·005	1
Carbonate of lime	4·57	=	0·014	2
Sulphate of lime	0·08			
Potash and soda	0·56			
Magnesia	0·87			

The atomic weight of their respective constituents thus shows, that the fertile soils differ from the sterile not only in the number of constituents, but in the proportion in which they are found to be combined.

From the above, the following conclusions are deduced:—

That absorption and emission of solar heat, in various proportions, constitute a physical property in soils, which property is connected with their productiveness; and that, as far as regards Australian soils, whenever, according to the averages of the tables, the amount of aborption is to that of emission as 5·76 : 1, this property of the soil is highly favourable to agriculture; and whenever it is as 2·34 : 1, it is highly injurious to it.

That the productiveness of a soil is influenced by a property, which the soil is found to possess, of absorbing atmospheric moisture; and that, as regards the Australian soils, whenever this property manifests itself in an amount above the average of that of the sterile soils, *i. e.* + 3·6, it is beneficial to agriculture, and when below, it is detrimental to it.

That the quantity of the soluble constituents in a soil determines its productive power; and that, as respects Australia, those of its soils which have 30 per cent. of soluble constituents are the best adapted to agriculture, and that those of which the soluble part is but 8 per cent. are the least fit for it.

That a certain amount of vegetable matter in

Australian soils is indispensable to their productiveness; 15 per cent. appearing highly propitious, and 5 per cent. highly injurious to it; and that it further appears evident, from synthetic experiments, that the amount of vegetable fibre in a soil regulates not only the proportion between its absorption and emission of heat, but also, in a great measure, its power of absorbing atmospheric moisture.

Lastly, that, as regards the mineral ingredients of the Australian soils, it seems very probable that a combination of one atom of the peroxide of iron with one of the sulphate of lime, five of the carbonate of lime, five of alumina, and thirty of silica, constitutes a fertile soil; and that a combination of one atom of the peroxide with two of carbonate of lime, three of alumina, and twenty-six of silica, constitutes a sterile one.

IMPROVEMENTS.

From the preceding survey of farms and farming, and from the examination of the different productive and unproductive soils, it is obvious that, great as are the number of actual improvements in the two colonies, the list of those which remain to be introduced must be still greater.

Hitherto, the colonial farmer has, generally speaking, attended to but one part of the great farming principle of aiming to produce the most at the least expense. That part which relates to combining both economy of capital and the highest profit with the continual increase of the productive power of the soil, has been lost sight of.

Innumerable examples of the evil consequences attending this neglect of farmers are on record; and many of the best known soils of the globe may be pointed out, as having at one time enriched their possessors by their fertility, while they have exposed those who succeeded them to immense expense and numberless failures; and this, through the sterility which abuse and mismanagement entailed upon them.

Liebig has quoted the case of Virginia, where "harvests of wheat and tobacco were obtained for a century from one and the same field without the aid of manure; but now whole districts are abandoned and converted into unfruitful pasture-land, which, without manure, produces neither wheat nor tobacco. From every acre of this land there were removed in the space of 100 years 12,000 pounds weight of alkalies, in leaves, grain, and straw; it became unfruitful, therefore, because it was deprived of every particle of alkalies fit for assimilation, and because that which was rendered soluble again in the space of one year was not sufficient to satisfy the demands of the plants." What in this respect came under the writer's personal observation, illustrates still farther the facts stated by Liebig: several of the principal farms both in Virginia and Maryland, where the cultivation is similar,—as, for instance, those belonging to Mr. Charles Caroll of Carollton, to Messrs. Caton, Harper, Oliver, Taloe, &c.,—had been a continuous source of ruinous expenditure and disappointment to their proprietors; and this for years, before they were brought to yield a tolerably good crop of wheat. Mistaken notions respecting the principles of the physiology of plants, and the agency of earths and alkalies in the process of nutrition, rendered that expenditure tenfold the amount which in the present day, with the assistance of "*chemistry as applied to agriculture*," would have been required to restore the productive power.

South America too, as well as North, presents several provinces, as the Sierra de Cordova, St. Juan de Arioja and the Maypu of Chili, where the richest soils of former times now yield nothing unless they are irrigated; which again, though furnishing alimentary substances to crops of wheat, must, through the process of a fresh and continuous disintegration of earthy salts and alkalies, end in draining completely the soil from such ingredients, and in rendering it fit only for a vegetation which lives on silica and carbon.

In New South Wales the effects of exhaustion of soils begin to be felt also, and in Van Diemen's Land similar examples are not wanting. The soils No. 36 and 37, of the farms of Mr. Jamieson, of Glenlee, which in the course of eighteen years of cropping, without manure, have lost half of their productive power, offer one of the most striking examples.

"A soil," says Liebig, "will naturally reach its point of exhaustion sooner, the less rich it is in the mineral ingredients necessary as food for plants; but it is obvious that we can restore the soil to its original state of fertility, by bringing it back to its former composition, that is, by returning to it the constituents removed by the various crops of plants."

Again, "the principal object of agriculture is to restore to our land the substances removed from it, and which the atmosphere does not give, in whatever way the restoration can be most conveniently effected. If the restoration be imperfect, the fertility of our fields or of the whole country will be impaired; but, if, on the contrary, we add more than we take away, the fertility will be increased."

The restitution, then, to the soil of what is subtracted from it by cropping, becomes the *imperative* and *sacred duty* of *every farmer:* to withhold it, with a knowledge of the injury thus inflicted on the soil, and entailed upon its next possessors, borders upon *a crime against society:* at any rate it becomes a most flagrant abuse of the gifts of nature.

Now, in order that such restitution may be accomplished systematically and with economy of time and money, there is required in Australia, as elsewhere, a previous knowledge respecting —

First, The constituents of the plants which are to be produced, by which knowledge we obtain an evidence of the kind of food that each plant requires from the soil.

Secondly, Respecting the physical and chemical character of the soil which is intended to produce these plants, by which we ascertain the store of provision it contains to meet the demands which will be made upon it.

Thirdly, Respecting the constituents or the chemical nature of the manures, by which we may be enabled in case of need to heighten the energies of the soil, and to apply the remedy with a knowledge of what we are doing, and consequently with success.

The published analyses of the ashes of different plants, and of the greatest number of manures, by Liebig, Boussingault, Dumas, and other chemists, who in their most praiseworthy devotion to the public good and to science, have not shrunk from all the disgusting contact and painful exercise of patience which such analyses imply and require, furnish most ample information on the first and the last of the above points of knowledge essential to the farmer.

On the second point, which relates to the analysis of soils, knowledge cannot be arrived at except through the assistance of an analytical chemist: but, although more difficult to obtain, it deserves, on account of the range of its usefulness, the most serious attention of the Australian farmer.

It is high time, indeed, when the progress of civilisation is becoming like the rise of a tide, *which drowns those who do not keep pace with its flow*, that the farmer, to whom science is ready to offer her services, should emancipate himself from the old hackneyed custom, under which he committed seeds to soils indiscriminately, and, in case of failure, applied remedies in total disregard and utter ignorance of the seat or cause of the evil; remedies, which, like the panaceas of a quack treatment, were experiments, but not improvements.

The knowledge of the three above pointed out requisites will lead the farmer to adapt either the plant and the manure to the soil, or the soil and manure to the plant, with equal success; and, in either case, without risk of time or money.

As a practical illustration of these rules:—Amongst the reviewed soils, and not included in the Table I. and II., are the soils No. 20, No. 25, and No. 29, of which the physical and chemical character is as follows:—

Number of the Soil.	PHYSICAL CHARACTER.				CHEMICAL CHARACTER.												
						Proximate Constituents in 100 Parts.											
	Absorption of Solar Heat.	Emission of Heat.	Capacity for Moisture.	Specific Gravity.	Soluble Parts in 100.	Vegetable Matter.	Water.	Silica.	Allumina.	Peroxide of Iron.	LIME.		Potash and Soda.	Chlorate.	Magnesium.	Metallic Oxides or Sulphurets.	Loss.
											Carbon.	Sulphate.					
No. 20	+ 12·	− 6·5	+ 5·	3·27	29·50	7·49	10·00	55·00	10·00	5·25	5·26	0·70	2·00	—	2·10	—	2·20
No. 25	+ 26·	−16·	+ 2·9	2·77	22·00	2·16	1·00	64·00	16·00	2·20	15·00	—	0·74	—	2·20	—	2·40
No. 29	+ 11·	− 4·	+ 2·	2·61	25·30	3·60	1·50	76·00	5·20	4·35	5·65	—	—	—	1·96	—	1·86
Mean.	+ 16·3	−8·8	+ 3·3	—	26·27	4·41	—	65·00	8·40	3·93	8·63	0·23	0·91	—	2·07	—	—

Their agricultural character, as described by the farmer, are pretty much alike; the three soils are all of high productive power; but their crops are liable to drought and frost, in circumstances under which the crops of other fields in the immediate vicinity do not suffer.

To correct the evil, the farmers applied lime, and had recourse to hurdling the sheep on the fields during the nights, but without attaining the object they had in view.

The cause of the failure, both of crops and of remedies, is obvious.

The examination of the physical character of the soils shows that their mean capacity for moisture is + 3; their mean absorption of solar says + 16·3; and their terrestrial radiation or emission 8·8; and, consequently, that the one is to the other in the proportion of 1·9 : 1.

Now, in the conclusions which have been drawn from the comparison of fertile and sterile soils, it has been said, that unless the capacity for moisture is + 14, and the absorption to emission is as 5·76 : 1, the production of crops will be precarious.

Hence, before the actual failure of the crop showed the inaptitude of the soil for it, both the frost and drought could have been predicated from the mere examination of the soil; and thus labour, time, and expense might have been saved.

But the examination which proves the defects of the soil, points out also proper remedies to correct them. Experiments which were adverted to in the section on climatology, lead to the belief that the presence in a soil of vegetable matter in certain quantities increases its absorption of solar heat; lessens its emission, and heightens its capacity for moisture; and that 15 per cent. of this matter is highly beneficial to a soil, and 5 per cent. highly injurious.

Now, in the instance before us, the chemical analysis of the three soils shows that, on an average, they possess but 4·5 per cent. of vegetable matter; and hence it is evident that the remedy lies in the augmentation of the vegetable part, by the sowing and ploughing in of the grasses.

But the advantage derived from the study of the physical character of soils intended for cultivation, is not limited to the mere question of *frost* and *drought*; that study can indicate to the farmer which soil, out of many productive ones, is the fittest or the best calculated for early crops. For example, in Table I. of the fertile soils, we see that the relation between absorption and emission of heat in the soil No. 3, is equal to that of No. 26; in both cases, the one property to the other is as 3·5 : 1; however, notwithstanding this, soil No. 26 will accelerate the vegetation, as, by virtue of its colour, it absorbs 21° of heat, in circumstances under which soil No. 3 absorbs but 7°.

The application of the chemical knowledge of the soil takes in a still wider range.

Soils No. 16 and 17, in the second table, are represented by Mr. Kermode as being unproductive and subject to frost. Now, the chemical analysis points out the cause of this sterility, in the presence of salts of the peroxide of iron, and in the absence of vegetable matter; and in disclosing the defect, it shows the remedy also, in the application of lime; by the addition of which, the subsulphate of the sequinoxide of iron being converted into peroxide, and the slacked lime into sulphate or gypsum, the soil will be raised from the lowest to the highest degree of productiveness. Sowing grasses, and ploughing them in, will complete the improvement.

But if horse-manure is at hand, it will supply both the exigencies most effectually, as by the analysis of horse-dung, we find that it contains 60 per cent. of magnesia and lime, both valuable ingredients, *per se*, and the more so in the case of the soil in question, on account of the presence of the salts of iron.

Thus, it may be seen, how a knowledge of the chemical and physical characters of soils will lead to the right application of manures, and to the process of restoring to the soil what is abstracted from it by cultivation, with a certainty as to the result.

The manures proper for such restitution, or amelioration and correction of the defects of soils, are innumerable. The one which is within the reach of the Australian farmer, and is the cheapest, answering even in an extreme case, is that derived from the farm-yard. "The solid and liquid excrements of an animal are of the highest value as manure for those plants which furnished food to the animal.

"The dung of pigs fed upon peas and potatoes is in the highest degree adapted as a manure for fields growing peas and potatoes. We feed a cow upon hay and turnips, and we obtain a manure containing all the mineral constituents of grass and turnips: this manure ought to be preferred, as being more suitable for turnips than that procured from any other source. The dung of pigeons contains the mineral ingredients of corn; that of rabbits the constituents of culinary vegetables; the liquid and solid excrements of man contain, in very great quantity, the mineral substances of all seeds."

But this most valuable farm-yard manure cannot be obtained of proper quality, and in sufficient quantity, to meet the exigencies of an Australian farm, except by stall feeding, or stabling the milch cows*, which requires the increasing of the pasture or green crops, which, again, cannot be done without the introduction of irrigation.

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* "The agricultural societies, the numbers of which are, in the present day, so greatly multiplied, would render a real service to agriculture, if they encouraged, by every means at their disposal, the economy of manures; if they established premiums for the farmers

who should show that they kept and managed their dunghills in the most approved and rational manner.

"The most proper spot on a farm for the manures to be deposited, is the vicinity of the stables and cow-houses. The localities may vary to infinity, but in every farm they should be such as to allow of the following conditions being realised.

"1st. That the liquid matter in the dunghill should not drain away from it. 2dly. That this matter should be gathered in a common reservoir formed in the ground, so as to be thrown back, in times of drought, on the solid mass. 3dly. That all watercourses should be prevented from emptying themselves in the depôt, or any other water, except the rain that falls on the surface. 4thly. That the area of the depôt be sufficiently large to obviate the necessity of heaping the dung too high. It is a great advantage, if the spot on which the manure is placed can be rendered slightly concave, and the reservoir fixed in the lowest part: also, if the soil be a stiff, impermeable clay: otherwise it will be necessary to lay a good pavement. The liquid matter from the dunghill, which collects in the reservoir, should be thrown back on the heap when the surface becomes too dry, by means of a pump. To aid this operation, Shaverty recommends moveable troughs or conduits placed on supporters, varying in length, and so adjusted one to the other as to carry the liquid to all parts.

"The mouth of the reservoir, which is necessarily under the manure, must be closed by a very strong wooden grating, the bars of which must lie sufficiently near together to prevent solid matter, straw, &c. from passing. Another most important and essential arrangement is, the having the slope or fall so managed, that the urine from the stables, &c., and the slops from the house, find their way, naturally, to the dunghill. The litter in the stables, however abundant it may be, never absorbs the whole of the urine, especially at the time when the cattle is fed on green food; and the fault that would be committed by neglecting to direct it to the dungyard would be unpardonable. The litter impregnated with excrement, and saturated with urine, must be brought in a barrow without sides, but the dragging it on a fork must not be tolerated, unless the distance be extremely short: if this distance be considerable, a very sensible loss would be thus incurred.

"The various composts should not be thrown carelessly on the heap, but duly spread and divided. An uneven surface occasions inequalities in the mass below, which, in course of time, produce mouldiness. The dunghill must also be properly and compactly piled, in order to check that rapid fermentation which is always prejudicial, and which is apt to take place when the manure is too loosely laid together. It requires special care to watch that the mass preserves, during hot weather, a certain degree of humidity on its surface, which is maintained by frequent use of the pump. At Bechelbrunnen, the manure is laid together sufficiently closely for a loaded cart, drawn by six horses, to pass over it without much difficulty. The height of the collected mass is not altogether unimportant. Besides the convenience of loading, which ought not to be forgotten, too great a thickness might be injurious, as causing too high an elevation of the temperature; and if, owing to circumstances, a mass of too great a thickness were left undisturbed for a long period, the decomposition might become rapid enough to occasion very serious loss. Experience has proved that the height of the dunghill ought to range between three and six feet. This height lessens gradually on each side until the extremities of the mass form a level with the soil; for it is the custom to preserve a convenient slope for the carts. In Alsace, the loading is performed on the dunghill itself.

"When circumstances, such as the small size of the farm, &c., do not permit the construction of a reservoir, and when the soil is porous, and the farmer has no means of paving, there is great risk of losing the juices of the dung heap. The plan then to be pursued, is to cover the surface of the hollow, in which the dung is deposited, with a layer of earth, sand, peat, or marl; in short, with any dry porous substance capable of absorbing the moisture. This is a practice often advantageously resorted to in Alsace.

"When the litter, impregnated with animal excrement, is accumulated in sufficient quantity, fermentation soon shows itself; the temperature rises, and abundance of gas is speedily disengaged. Among the volatile components of this decomposition, is carbonate of ammonia, which it is important to retain. This is done by keeping the mass in a suitable state of humidity, and by favouring, as much as possible, the access of atmospheric air. The daily addition of fresh litter from the stables, &c. powerfully contributes to prevent the escape of the volatile principles it is so important to preserve. If laid on judiciously, it becomes a check to this evaporation, forming a cover which acts as a condenser, at the same time that it preserves the lower layers from a too immediate contact of oxygen. So long as the dunghill is managed in this way, the fermentation is kept from spreading to the inferior layers of the mass.

"Thaer found that the stratum of air which is immediately above the surface of a heap of manure, subject to a moderate fermentation, does not contain much more carbonic acid than that which is further distant. The slow decomposition which this proves, and which is advantageous, is not easily maintained, except in masses sufficiently compressed, and in which the litter has been spread as equally as possible. One important point is to remove the dung before the upper portion, recently added, begins to enter into the state of decomposition; otherwise the entire mass is drawn into full fermentation, and the volatile matter, being no longer arrested by the upper layer, escapes into the air. A means of preventing this loss, when (which is rarely the case) there is a reason for wishing the fermentation to spread itself at once through the

In order, however, that the value of irrigation may not be misunderstood or overrated by the colonial

entire depth of the mass, would be to cover it with vegetable mould, in which the volatile principles would become condensed. The soil that served as a cover, would then be converted into a powerful manure. When the fermentation is carefully watched, and prudently managed, I do not hesitate to say that the loss of ammonia is inconsiderable. The fermentation, in such case, presents a character differing essentially from that which marks the rapid putrefaction that does not fail to develope itself when the proper precautions are neglected. As an example of a hasty and unfavourable fermentation, I may mention that which takes place in droppings of horse-dung. I have seen them when left untouched, and when not exposed to the contact of water, acquire, in a few days, a very intense degree of heat, and take fire. I have seen them thus become reduced to a mere earth. Such are not the results of the gradual decomposition of horse-dung.

" When the receptacle is emptied in which the slow fermentation has been going on, the upper layer is found in pretty much the same state as when it was brought there; the portion immediately beneath has undergone some change, a slight odour of ammonia being perceptible. In the inferior strata the change is great; the straw has lost its consistence, it is fibrous and easily crumbles. When taken from a still greater depth, the colour of the compost is darker. That nearest the bottom is quite black; its scent is that of hydro-sulphuric acid: we recognise in it sulphuret of iron; and doubtless these sulphuric products are the consequences of the decomposition of sulphates under the influence of organic matter. It is by this sign that I recognise the goodness of the compost for the farm. The presence of sulphurets, and of the hydro-sulphate of ammonia, need not create alarm; for scarcely is the dung spread upon the soil, than these products transform themselves into sulphates, and soon emit that musky odour which is peculiar to those substances.

" Doubtless, the state in which such manure is found is owing to the manner in which it has been placed and preserved during the entire period of its change; the elements would have followed quite another course in their decomposition, if they had been left exposed to the open air. To be convinced of this, it is only necessary to notice the purely ammoniacal odour which is so strongly developed during summer in stables, where the urine of horses and cattle stagnates on the ground.

" It will be easily understood how unfavourable to the good preservation of manure must be the custom, common in certain countries, of turning it, as it were to *air* it, in order to hasten its decomposition. Thus treated, it does indeed decompose more speedily, but that result, the object of which I cannot exactly understand, is not attained except by the sacrifice of the quality of the compost; for it is evident that its volatile principles evaporate the more easily, the more their points of contact with the air are multiplied." — *From Boussingault's Work on Economie Rurale, &c.*

agriculturist, it is necessary to state that, as applied to the soil, it is *not* a manure, but that it is instrumental in rendering the action of manure beneficial: *per se*, it does not enrich the soil with any marked element of productiveness, (unless the water contains some salts in solution,) but it serves powerfully to develope the richness the soil itself contains. "On a soil poor in mineral food, cultivated plants do not flourish, however abundantly water may be supplied to them." In dry climates, like those of Chili, Peru, Lower California, New South Wales, and Van Diemen's Land, its agency on a soil becomes precisely similar to that exercised in moist climates by a slacked lime dressing.

Both operations are only the means of effecting a further disintegration of particles, and a further decomposition of valuable salts and alkalies, which, without the assistance of such solvents, would remain inert in respect to the nutrition of plants: hence, however great and wonderful may appear its action on vegetation, water is, nevertheless, only what Liebig determined it to be, "a mediating member of all organic life."

In Australasia, numerous traces are seen of the escape of carbonic acid gas through fissures of the earth: in Van Diemen's Land, these are more frequent than in New South Wales; and in the upper country, more developed than in the lower. Of these traces, the most remarkable is that offered by dead trees, and by some long stripes of a stunted and sickly vegetation ranged in lines parallel to the axis of perturbation, and producing an effect similar to that observed by the writer in Hawaii (Sandwich Isles), and Sumbawa, where the escape of carbonic gas, by excluding oxygen from the soil, rendered the latter comparatively sterile. From this circumstance, the waters in both the colonies, particularly at their source, are impregnated with this acid, and are charged with many mineral salts. In many instances, passing through calcareous rocks, or such as contain calcareous matter, they carry with them the dissolved lime, and, on evaporation, incrust with it all vegetable or mineral substances which they meet in their courses. The chemical character which the waters of New South Wales and Van Diemen's Land thus possess, renders them doubly valuable in irrigation.

Its introduction in Australia is both practicable and easy, though more so in Van Diemen's Land than in New South Wales.

To restrain the extraordinary fall of rivers by damming up their courses, to make reservoirs, or to restore the old natural basins of lakes in the upper country; to bring the waters in their gradual descent to bear on the agricultural land, or to raise them by simple contrivances of windmills, pumps, or hydraulic belts, to the required level, still remain as means of irrigation to be adopted; the trouble and cost of which have been much exaggerated, but which have been most extensively accomplished by people of less energy, less industry, and less capital than the Australian settler possesses; subject also to trammels and restraints on the part of their unenlightened rulers, of which the Australian can scarcely form any idea. (South America.)

In New South Wales, the river Karua, and the tributaries of the Hunter, afford a most extensive range for the introduction of irrigation: the whole country of Cumberland may also be laid out in irrigated lands, by means of the Grose and Warragambia, Hawkesbury and Nepean rivers, and with the aid of cheap wooden aqueducts. The river Nepean for the county of Campden; the Wollondilly, for Argyleshire; the river Cox, for the vale of Clywd; and the Campbell and Macquarrie, for Bathurst; all offer most valuable water-courses for reclaiming or for increasing the productiveness of the comparatively sterile lands. The lower portion of Gipps Land, sheltered, as it is, to the northward and westward by the dividing range, and watered by five fine rivers, may be rendered, by irrigation, a most flourishing portion of the colony.

In Van Diemen's Land, the central elevation, containing, at an average altitude of 3000 feet above the plains and valleys, five lakes constituting more than 200 square miles of superficial extent, and which by trifling embankments may be extended to double that area, appears to the traveller as if created for the special purpose of affording irrigation. In point of supply of water, and of the natural facility for regulating it, there is, perhaps, no situation equal to it in the world.

A wise legislation upon the right of appropriating and conducting the water through different properties, a general concurrence of efforts towards the extension of irrigation, and the bringing over of some few practical men from Chili or British India, to show the cheapest mode of effecting it, is all that is wanted: labour, which is becoming every day cheaper, will do the rest.

On its usefulness and necessity it is superfluous to expatiate. It will suffice to remind the colonial reader, that in Van Diemen's Land, Mr. Kermode reaped five tons of fine hay and twenty tons of potatoes from an acre, and this upon a soil which, before irrigation was applied to it, produced nothing; and that Mr. Jamieson raised the exhausted power of production in a soil, by one year of irrigation, from eighteen to twenty-five bushels per acre; and lastly, that in Sinaloa and Sonora, wheat gives a return of sixty fold; maize, of from 120 to 220; and this in an exceedingly dry climate, on a soil of which the mineral constituents are similar to the Australasian soils, and entirely through the effects of irrigation.*

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* Hacienda de Los Labores (Mexico). — I have not yet been able to recover from the surprise which my sojourn in the province of Sonora has occasioned me. Each step I take, presents me with some fresh cause for its renewal. My excursion to this farm has been a very agreeable one. In this corner of the Spanish American republic, where my preconceived notions, derived from men and books, presented me only with images of wild Indians, I have found white men united in civilised communities, and animated with the active desire of progress and improvement in the career which independence has opened to them. I have found their intercourse most pleasant, their hospitality large as that of the Koran, and their inner, or mental life, wonderfully developed. In fact, when the short period of time and the limited means, or rather the total want of those means, which elsewhere facilitate, encourage, and promote amelioration, are considered, the people of Sonora may be said to have made gigantic strides in the path of improvement.

The hacienda of Los Labores, where I now am, is the finest among many farms I have visited in Spanish America, which constitutes the *home* of its proprietor. Every where else they cultivate their farms purely as a means of speculation or produce, — rent or gain being the only object of agriculture. They never visit them except when obliged to do so, and then, only make a brief stay. Here the owner, without losing sight either of produce or profit, finds, nevertheless, in the mere cultivation of the soil, the principal attraction of agriculture; he struck root in it like the trees of his garden; and, although severed as he is from all acquaintance with the valuable innovations which have affected this important branch of industry in Europe, he has, by his unwearied pains and his continual personal superintendence, more than quintupled the value of his farm during the thirteen years that he has been its proprietor.

This beautiful estate, lying twelve leagues north-east of the Pitic, and comprising an area of eight square leagues, extends partly along the flat of a valley, partly along the slopes of the mountains which enclose it. A third of the whole is under cultivation. The flat bottom of the valley, all of which is now under tillage, was formerly a forest of acacias, which have been destroyed by the axe. At present its excellent soil, tolerably well irrigated, and protected by impenetrable hedges, is covered with rich harvests, which surround, when gathered in, the farm-yard and the house of the proprietor.

The evening mists were falling when I arrived here yesterday, so that I could only form a partial idea of the scene; but this morning I was out of doors by day-break, and found my host on foot also. Full of activity and ardour, he sought to reanimate the labours of the farm-yard, which the night had suspended. His example found but few imitators, and his zeal was little responded to. The denizens of the

But introducing irrigation, raising pasture, stabling the cattle, obtaining manure, and manuring the soil,

farm-yard aroused themselves slowly and reluctantly, as though fettered and shackled in all their movements by the *serappe* or *poncho* that enveloped their persons. The nonchalance and indolence of the numerous in-door dependents contrasted singularly with the busy aspect of the fields. There the Indian, on whom the field labour devolves, had risen with the sun, and already animated every nook with the signs of active industry. The appearance of the fields struck me greatly; never before had I beheld a more smiling scene. The wheat, four months old, spread its brilliant verdure, like a rich velvet robe, over extensive tracts, lost to the eye in the windings of the valley. On the other side of the picture the gathering in of the maize harvest could be seen, an unusual sight in Spanish America — a multitude of women and children appeared busy at work in the midst! "This is indeed a rare sight," I observed to my host; "how have you been able to turn the services of women and children to account? You have worked a miracle, which is every where else in this country considered impracticable!" More pleased than mortified, he answered, "Undeceive yourself, — all the people here are gleaning for their own benefit, and by virtue of a right established for centuries. The reapers who work for me are aware that I respect this right, and never fail, whenever an opportunity presents, to increase the gains of their wives by purposely adding to the number of ears of corn left strewn on the field through negligence. They take a quarter of the whole, so that, including the other quarter which they cost me in wages, we may be said to go halves every harvest, if, as friend Gil Blas says, 'arithmetic is an exact science.' But God is good; they do not ruin me: the harvest increases yearly." The second farm, situated two leagues further off, and which we likewise visited, possesses the same kind of soil, and is under similar culture, if the word culture can be here properly applied. The plough, modelled upon that of the ancients, does but irregularly scrape up the earth; the grain committed to it, is rather dropped than sown; the harrow, a faggot of prickly branches, drawn by one horse, slightly scratches over the surface, and thus terminate the labours of seed time. The method of harvesting is not any more edifying. A small sickle, one third the size of those commonly used in Germany or England, cuts the wheat, only a little below the ear; the sheaves, when gathered and bound, are carried upon asses, mules, or horses to the appointed spot, a kind of Olympic circus, in which the gallop of the horses shakes out the grain from the ear. The operations of winnowing, sifting, &c. correspond. The management of the farm is carried on without calculation, combined plan, or control. Encumbered with a multitude of idle hangers-on, it presents in every department little order and still less economy. Thus it is that the current expences of cultivation absorb one half of the income. This result, however, startling though it be, is imperceptible. The proprietor himself was astonished, when I proved it to him by figures; for the amazing fertility of the soil helps to cover and to render less sensible are not sufficient to maintain its productiveness for the continuous growth of one plant.

all waste or deficit, which the defects in the mode of culture necessarily entail. The produce of 60 fanegas of wheat sown is 5000, that is to say, 80 for 1; 10 fanegas of maize yield 1800, or 180 for 1; and 10 of beans 400, or 40 for 1!

The wheat is sown in October, and, when reaped in May, is followed by maize or beans, which, when gathered in September, is again followed by wheat. Thus, the soil never rests; two harvests have been cut annually for twenty years, *without any manuring* having taken place.

The number of day labourers on the farm amounts to 100 men, who are Yakie and Pimas Indians. This number is increased by 30 during the two harvests. The families of these 130, scattered among the Ranchos which surround the farm, make altogether 500 souls, who all live by the privilege of gleaning, and other largesses which mark the benevolent character of the proprietor. I append the rate of wages, which is interesting, considered in connection with the low price of corn:—

	In silver.	In wheat.	In silver.	In wheat.
The bailiff or superintendent of the farm			450$	380$
Ten sub-bailiffs			240	746
Fifty peons at 5$ in silver, and 2$ in wheat per month, per annum			3000	1200
One herdsman			120	36
One field ditto			96	24
Five ditto	6$	2$	360	120
Two Arrieros	10	3	224	72
Four ditto	8	2	380	96
Two ditto	6	2	144	48
Two ditto	5	2	120	48
One overseer of the mill			120	174
Six sub-ditto, 6$ silver, and 2$ in wheat, per month			452	144
Thirty peons at 5$ silver, and 2$ in wheat during two months of harvest			300	120
Total of wages, in wheat and in silver				9,650$

The farm is liable to no direct imposts, these having been redeemed, thirteen years ago, for 22,000$. Its present income, consisting of the produce of the sales of wheat, maize, and beans, amounts to 20,000$, and its expenditure, in wages alone, to the exorbitant sum of 9650$.

The house of the proprietor is a substantial, massive structure, furnished similarly to town-houses, and abundantly stocked with every description of provisions, and foreign wines and liqueurs. The garden contains plantations of vines, citrons, oranges, quinces, peaches, and

Whether it be owing to the excrementitious matter ejected by a plant, or to some other obscure cause, still to be explained, it is known by experience, that any one kind of cultivated plant intended for the use of man and animals soon impedes its own developement, if allowed to grow in a soil without alternating with another kind. It is further proved, that the longer the time which intervenes between each kind of crop, the greater the reproduction of the soil and the vitality of the plant; thence a system of regular and rational rotation, founded on a knowledge of the chemical character of the soil, and the plants which are about to be alternately produced by it, becomes indispensable in a well-managed farm.

In New South Wales and in Van Diemen's Land, the rotation which is in practice is as yet unconnected with the principles of the science of agriculture. In most cases, it is the mere consequence of an erroneous idea, which the vaunted capabilities of virgin soils have engendered. Thus, in the description of some of the

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apricots, and a variety of European vegetables, all carefully and scientifically cultivated. Every where abundance is visible; every where are seen the signs of an open, generous hand. Avarice, penuriousness, want, and suffering seem to be unknown; health, peace, and content appear to reign in undisturbed possession of this region. It is on my host, however, that they lavish their brightest favours.

Don Joaquim de Astiazaran is, in his physiognomy and manners, his thoughts and actions, a true picture of a kind-hearted country gentleman, in harmony with himself and with all about him. Far from the tumult of active life,—undisturbed by the thirst of fame or power, he tranquilly spins the thread of his days in the happy uniformity of pleasures which the cultivation of the soil affords, and of the domestic comforts which his fortune procures him. Undisputed sovereign upon his eight square leagues, what are to him the events that take place beyond? Ye crumbling empires of the world! ye revolutions which engulf both kings and people! ye federalists and centralists of Mexico! though ye should rise *en masse*, be it known to you beforehand, that if ever the echo of your tumults should resound so far as to be heard amid the quiet haunts of this peaceful farm, neither your objects would there awaken any interest, nor your disasters any sympathy, nor yet your triumphs any admiration.—*MS. Journal of the Author.*

colonial soils, the rotation which was recorded shows that wheat, tobacco, or maize, the most exhausting of all cultivated plants, were grown in succession, or alternated with each other, on the same, frequently unmanured soil.

Generally speaking, the Australian soils approximate very much in their character to those of the eastern part of Prussia, where the agricultural school of Möchlin, directed by the revered Thaer, has introduced a seven years' rotation, which, in its application, has proved of the greatest benefit to the country. In Australia, however, with the assistance of irrigation and manures, the rotation may be limited to five years, according to the following plan: —

First Year.	**Second Year.**	**Third Year.**	**Fourth Year.**	**Fifth Year.**
Manure. Turnips fed off.	Wheat and Clover.	*Lucerne* (*Alfalfa*) *Feverolle;* the first crop taken off, the second ploughed in.	Oats.	Wheat and Clover.
Manure. Potatoes.			Turnips fed off.	

In the arrangement of the above system of rotation, the necessity of alternating one plant with the other was combined with that object of not less value and importance, which consists in enriching the soil through the medium of the produce itself, independently of the manure which is given to it.

The Australian agriculturist, situated as he is in regard to the market to which he must bring the direct produce of the fields, in order to obtain a return for his labours and outlay, should be perfectly conscious of the position which such export of the crop places his farm in.

This important question, bearing upon all the highest principles in the political economy of a country, did not escape the attention of the first of agricultural and chemical philosophers. "Exporting grain from a country," says Sir Humphrey Davy, "which does not receive in exchange substances capable of giving a manure, must ultimately exhaust its soils."

In England, France, Germany, and Italy, the sending away of grain, straw, and hay from a farm, receives an equivalent in the imported bonedust, *poudrette*, guano, &c.

But the importing of manure would be too expensive for countries like New South Wales and Van Diemen's Land: science, however, offers to them more attainable and cheaper means of supplying the continual loss and subtraction of fertilising principles from a soil, and it requires but unprejudiced minds to check effectually a growing and threatening evil.

Vegetable life has been found to derive its substance, in some cases, entirely from water, in some, from the air, in some from the mineral constituents of the earth; in others, again, the combined agency and concurrence of air, earth, and water are required.

In all cases the plants are found to possess in common the four elements of organisation, and some of the earthy ingredients, differing only in the proportion in which these constituents are combined.

Nitrogen, that most energetic agent of production and of life, has been discovered to be present in considerable quantities in some of those plants, which are thought, with great probability, to need from the soil only its mechanical assistance, and to derive almost all the azote they contain from water and air.

To this kind of plant belong the faba and fabula, the feverolle, lupin, and lucerne.

Hence the cultivation of these plants on a farm, and the ploughing-in of their second crop, have proved, from the remotest antiquity, of wonderful benefit to the succeeding crops of wheat and maize, and prove so still, wherever this is practised.

Hence, also, in the proposed rotation, the plants alluded to intervene between the crops of wheat, as a supplement and auxiliary to the manuring, which is presumed practicable only once in every five years.

The tendency of all systems of rotation is that of an adjustment of the succession of crops and manures in such a way, that in raising the greatest amount of produce, the fertility of the soil is raised also. The test, therefore, of their value will, with the advancement of science, resolve itself into a question of balance between the fertilising principles which are abstracted from the soil by the produce, and the amount which is returned to it by manures; in which question, if the numerical result shows that we return more than we take away, the system of rotation is good; if the contrary, the system must be bad.

This has been already demonstrated practically and satisfactorily by that eminent traveller, chemist, and agriculturist, Boussingault*, who, with an untiring perseverance, equalled only by his abilities and love of science, lately devoted one year to the chemical analysis, on the one hand, of all the produce which the soil yielded during five years on the farm of Bechelbrunnen; on the other, of all the manure which during that time the farm returned to the soil, in the shape of dung, ashes, gypsum, grasses, stalks, and roots left behind by the harvest, and ploughed in.

The first analysis gave the element of the fertilising principle abstracted from the soil.

The second gave that which was restored to it; and the balance between the two proved that, owing to the judicious rotation, the soils of the farm, instead of losing, gained, in five years, on an acre —

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* Since writing this, the English translation of Boussingault's "Agriculture" has been published, and, from the range of its usefulness, cannot be too strongly recommended to the English and Colonial farmer.

Acids	Phosphoric	pounds	34·96
	Sulphuric	,,	694·37
	Chloric	,,	37·72
	Lime	,,	1046·04
	Magnesia	,,	197·78
	Potash and soda	,,	285·52
	Silex	,,	11,885·25

The services rendered to agriculture by the inquiries of Boussingault are of the greatest value: they introduce a positive mode of procedure in agricultural experiments, and by the results they give, will incite either the English public or the English government to assist the able chemists, of whom this country may be justly proud, to devote their time and labour to similar inquiries, and thus enrich the farmer on this side of the channel with data by which he may test his improvements.

Next to irrigation, manure, and rotation, change of the seed of wheat, is a matter of paramount importance and necessity with the greater number of Australian farmers; indeed, without it, all the other improvements are of little avail.

The wheat-grain has, with some exceptions, deteriorated throughout the two colonies: it has a greater per-centage of bran or husk, and a smaller amount of the azotised principles of gluten and albumen, than that originally imported into the colony.

The analysis of wheat raised on the greater number of small farms of New South Wales and Van Diemen's Land has generally shown a deficiency in azote: in cases where the land is exhausted, such deficiency is extraordinary, and proves that the poorer the soil, the poorer the wheat is in those elements which constitute the nourishment of man and animals, thus rendering the conclusion obvious, that unless a proper agricultural system be introduced, the grain will deteriorate still farther.

The following table places the quality of some of the European, American, and African wheats in their juxtaposition.

TABLE SHOWING THE PROPORTION OF GLUTEN CONTAINED IN 100 PARTS OF THE WHEAT OF DIFFERENT COUNTRIES.

Locality of the Wheat.			Per-cent of Gluten.	Average.
	EUROPE.			
England	(Winter)	(Davy)	19·	22·5
"	(Summer)	"	24·	
Bavaria		(Vogel)	24·	
Sicily		(Boussingault)	21·	
France	Roussillon	"	22·6	
Prussia	Dantzig	"	22·7	
Poland	Odessa	(Vauquelin)	26·0	
	ASIA.			
Turkey	Smyrna	(Boussingault)	19·9	21·6
East Indies	Naypoor	"	18·6	
Arabia	Mecca	"	23·8	
Russia	Taganrook	"	24·0	
	AFRICA.			
Egypt		"	21·6	22·0
"		"	26·5	
Cape of Good Hope		"	18·	
	NORTH AMERICA.			
United States,	Vir., Richmond	(Strzelecki)	19·5	21·3
"	Maryld., Caton, Esq.	"	20·2	
"	Carroll, Esq.	"	18·3	
"	Harper, Esq.	"	17·2	
"	R. Oliver, Esq.	"	22·0	
"	Virgin., Taloe, Esq.	"	20·0	
"	N. Yrk., Albany	"	15·0	
"	Vandalia	"	26·3	
"	Cincinnati	"	23·0	
Canada	Quebec	"	21·5	
"	Montreal	"	19·0	
"	Toronto	"	18·0	
Mexico,	Senatos Los Labores Hacienda	"	28·0	
"	Sonora (Yakies)	"	30·0	
"	Culican	"	25·0	
	SOUTH AMERICA.			
Brazil	Rio Grande	"	23·0	17·9
"	St. Borgie paiz delos Miss.	"	20·1	
Arengentine R.	Cordova, St. Francisco	"	12·5	
"	St. Juan de Arioja	"	15·6	
"	Mendoza	"	13·0	
Chili	Hacienda Huaychun	"	22·0	
"	Maypu	"	18·	
"	Antacola	"	16·0	
"	Chacabouco	"	15·0	

In the foregoing table, we see the highest average of gluten is 22·5 per cent. in European wheat, and the lowest in South American is 18 per cent.

If we take the amount of gluten in twenty-five different specimens of wheat in New South Wales and Van Diemen's Land, its average will be greatly below that of the South American.

It would be really invidious and injurious to the Australian farmers to insert here the localities where the wheat, which has been analysed, was grown: suffice it to say, as a warning against the evil with which the most essential interests of society are threatened, that the gluten of the wheat of some of the farms, in both the colonies, does not amount to 4 per cent.

Exceptions are on record; and some of these — as the farm of Strout (Australian Agricultural Company) of Cambden (Mr. M'Arthur's), Ballangola, and that of Captain Rossi's, — are mentioned here, as, from the circumstance of the wheat grown on them containing the highest average of gluten in New South Wales (16 per cent.), they may furnish seed to those farms on which the grain has a lower per-centage of that ingredient.

In Van Diemen's Land, the wheat of Mr. William Archer, grown on the farm of Brickendon, may be pointed out to Tasmanian agriculturists as the best in the island: it contains 18 per cent. of gluten, and its bran does not amount to 22 per cent.

Liebig has shown, that the azotised matter in wheat depends upon the kind of manure; and Stermbstädt has demonstrated by experiments, that wheat raised with the manure of human urine gave 35 per cent. of gluten, while that raised on a soil without manure gave but 9; and thus, too, all wheat below that per-centage found in New South Wales and Van Diemen's Land, was observed and noted as being grown on an exhausted and unmanured soil.

The necessity of seasoning the seed of wheat, to avert diseases from the crop (such as blight, smut, &c.), may be also alluded to.

While in Tasmania, the writer took the liberty of suggesting the use of sulphate of iron; since then, however, Boussingault, who, in these matters, is of great authority, has recommended the sulphate of copper, *three ounces to a bushel of wheat, diluted in a quantity of water sufficient to cover the grain,—the soaking not to exceed three hours:* and this recommendation, based as it is on most gratifying experiments and results, cannot but be acceptable to Australian agriculturists.

CONCLUSION.

With the introduction of these and other agricultural improvements, which the advance of science daily brings forth, into the two colonies, there is not the least doubt but that the Australian soil will be raised from its present impaired, and in some parts, inert state, to the yielding of fifty bushels per acre; and that in that rise, the agriculturist will find the best protection against the competition of foreign markets.

The melancholy events which have of late taken place in these colonies, will unfortunately retard, for a while, the amelioration of agriculture. They were unavoidable, and took their rise, not in the country's being ill adapted to become a prosperous colony, but in the fluctuations of immigration, and importation of capital, which no measure or provision can control, and which is constantly disturbing the equilibrium of the relative value of different kinds of property in a new community.

Thus, when money was abundant in the colonies, it of course became cheap, and the price of every commodity rose: again, when money was scarce, it became dear, and every commodity was depreciated. The first state of the market introduced into the colony fictitious wealth, and habits of luxury and speculation: the second produced a nominal distress, but fostered notions of economy and industry. Little could have been expected from the former; from the latter much good will arise. The colonies have reached *an age* or period in their developement, in which they are able to regulate their own wants, supplies, and productions; the energies of the colonists are awakened, and their abilities and attention are directed into a right course.

But it must be admitted, that, in an agricultural point of view, the two colonies labour under difficulties which it is not in their own power to remove. The first is, the present uniform price of land, viz. 1*l.* per acre. Now, in the early part of this section, it has been clearly shown that the Australian land admits of being classed into at least two kinds, viz. the pastoral and the agricultural: it has been further shown, that at least seven acres of the former class of land are necessary to maintain a sheep of the value of two shillings, and which, on an average, produces but two pounds and a half of wool. Such a fact, coupled with that of the prime cost of the land being 1*l.*, needs no comment. Even for agricultural purposes 1*l.* is too high a price, when it is considered that the English farmer cannot render available his land without irrigation, and introduction of other agricultural improvements; and when it is recollected, that if he can but make up his mind to alienate himself from the mother country, he may buy, in the United States, excellent land at *three shillings per acre!* Secondly, The making of communications, those arteries of commerce and industry, should not be entailed on the buyer of land. Those who sell a property should find means of rendering it accessible to those who buy it; they should, in good policy, render it accessible even to those who wish to examine it, whereby much valuable land would be disposed of, which, for want only of the means of access, remains on the hands of the Government. The discovery of good lands by settlers, and the seeking for communications and outlets, have been fruitful of most serious evils, and, in many instances, have proved fatal to explorers: a good many settlers and their men being missing, who have most probably perished in the scrubbs. In New South Wales, the writer with his party was obliged to cut his way through a scrubb during four weeks, advancing at the rate of three miles per day, and having to abandon a property in pack-horses, and various valuable articles which they carried, to the amount of 700*l*., and this too after leaving Gipps' Land, the most beautiful portion of the colony. In Van Diemen's Land, while exploring the eastern part of the island, between Launceston, Cape Portland, and St. Helen's river, he came on a most beautiful tract of country, but, in order so get out of it, was obliged to cut four days through the densest scrubb imaginable. The third point is connected with the disposal of the Australian grain in the English market,—Canada has obtained this privilege, and why should not the Australian colonies?

There is no doubt in the writer's mind, that, if represented properly and in proper quarters, these grievances, weighing heavily upon the colonial agricultural interests, and hence impeding the introduction of the required improvements, will obtain attention and will be removed. No doubt, too, the example which England now sets will not be lost upon the colonies. The era is grand, and unparallelled in British history!

The highest nobility lead the way to a new national glory — the glory of the perfection of agriculture! The Dukes of Richmond, Rutland, Portland, Buccleugh, and Sutherland, Lords Spencer, Ducie, and Aberdeen, Sir Robert Peel, &c. &c., are at the head of the movement, and identifying themselves with that noble profession, "*upon which the welfare and development of the whole human species, the richness of states, and all commerce, depends.*" Associations of all denominations, men of all vocations, labour to diffuse truth and to combat error and prejudice. The patriotism, or rather nationalism of the people, shows itself in the noblest light, and scientific contributions are welcomed to England, from whatsoever quarter they arrive. The Government, too, which had hitherto left the promotion of science to the efforts of individuals, conscious of the importance it assumes, as connected with the welfare of society, and conscious that the subdivision of interests and occupations renders individual exertion unable to keep pace with its progressive development, now identifies itself most liberally with scientific objects; and the "Economic Geology," under Sir Henry de la Bêche, is established to furnish both to scientific men and to agriculturists, miners, mechanics, artists and artisans, not only an accessible reference and authority for the solution of questions, but also a cheap assistance in the analysis of soils, and other substances relating to arts and manufactures. Will such a movement in England have no reaction upon the colonies? Will the agricultural associations of England and Scotland remain indifferent to the advance of colonial agriculture? And the Government, which has so liberally come forward at home in aiding the practical application of geological science to all the branches of industry — will it forget that the agriculturists of Australia are at a distance of 15,000 miles from the focus of inventions and of references, and left without the assistance even of a geologist or analysing chemist?

In the position in which the writer finds himself with regard to England and her colonies, he cannot say more, without incurring the reproach of intruding upon a subject which does not belong to him; but he may be allowed to add, that no one deserves a greater sympathy from England than the Anglo-Australian settler; and that, in his opinion, no colonies will react more beneficially upon the welfare of the mother-country than New South Wales and Van Diemen's Land.

THE END.

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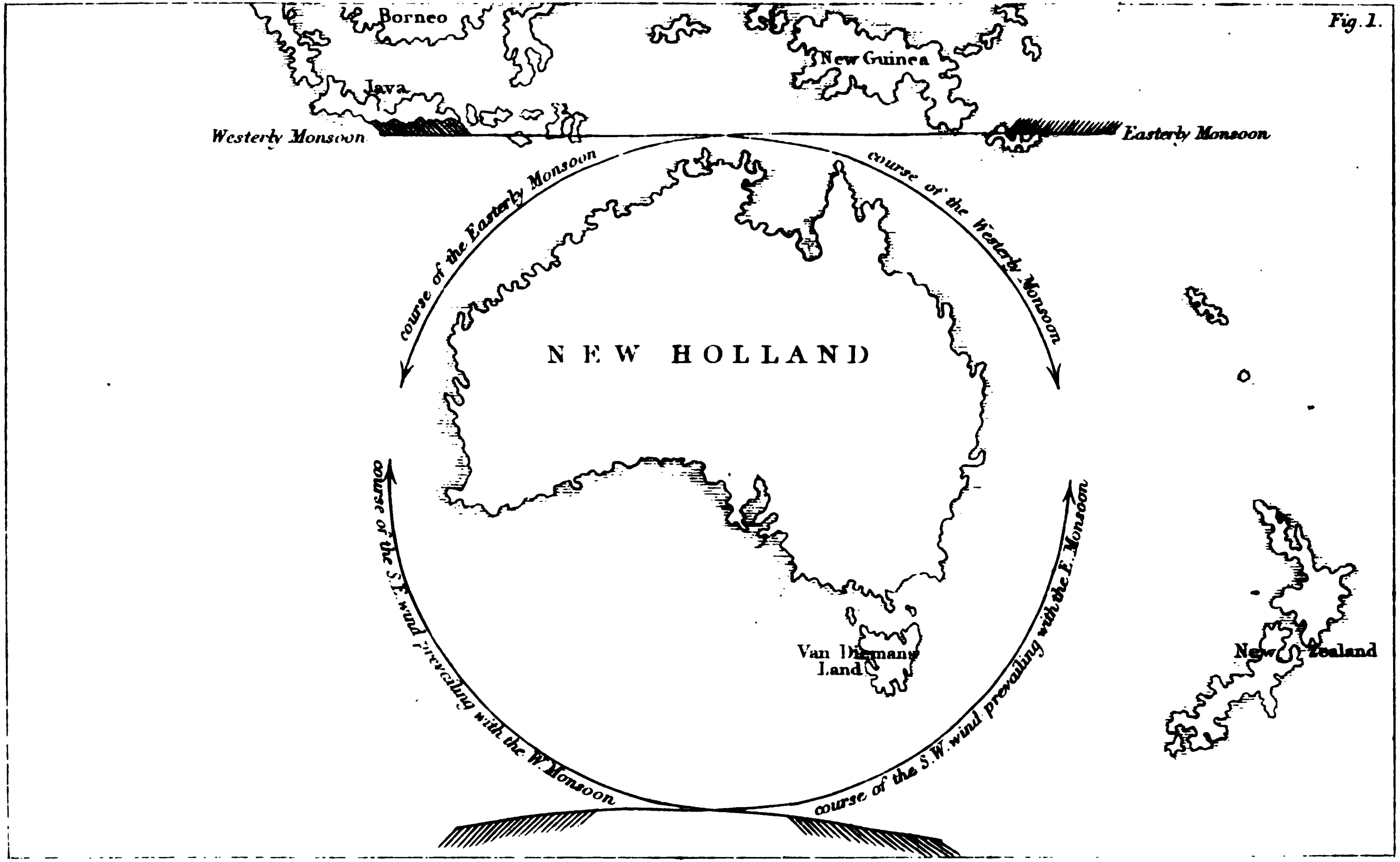
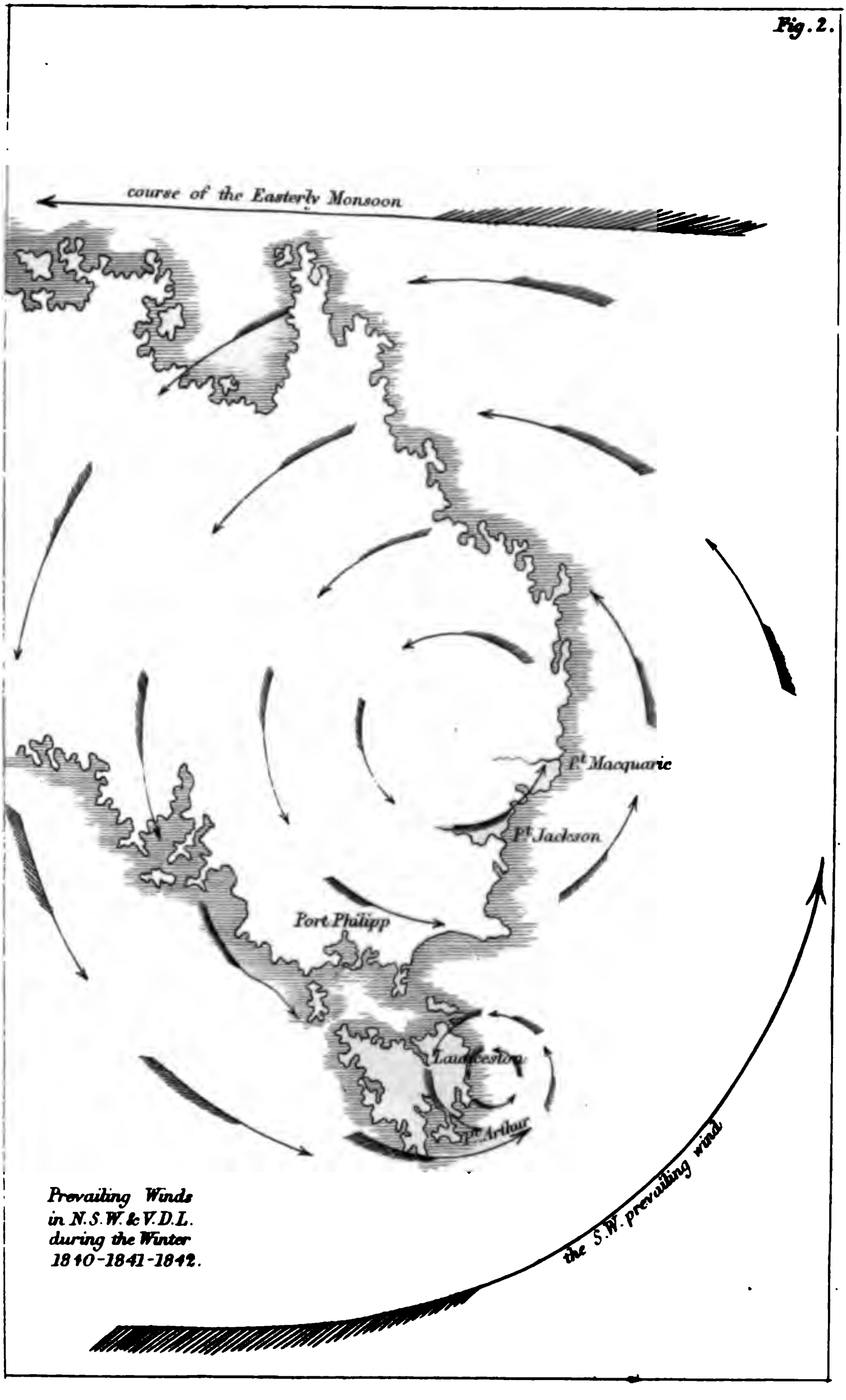
PL. I.

Fig. 1.


Borneo
Java
New Guinea
Westerly Monsoon
Easterly Monsoon
course of the Easterly Monsoon
course of the Westerly Monsoon
NEW HOLLAND
Van Diemans Land
New Zealand
course of the S.E. wind prevailing with the W. Monsoon
course of the S.W. wind prevailing with the E. Monsoon

Pl. II.

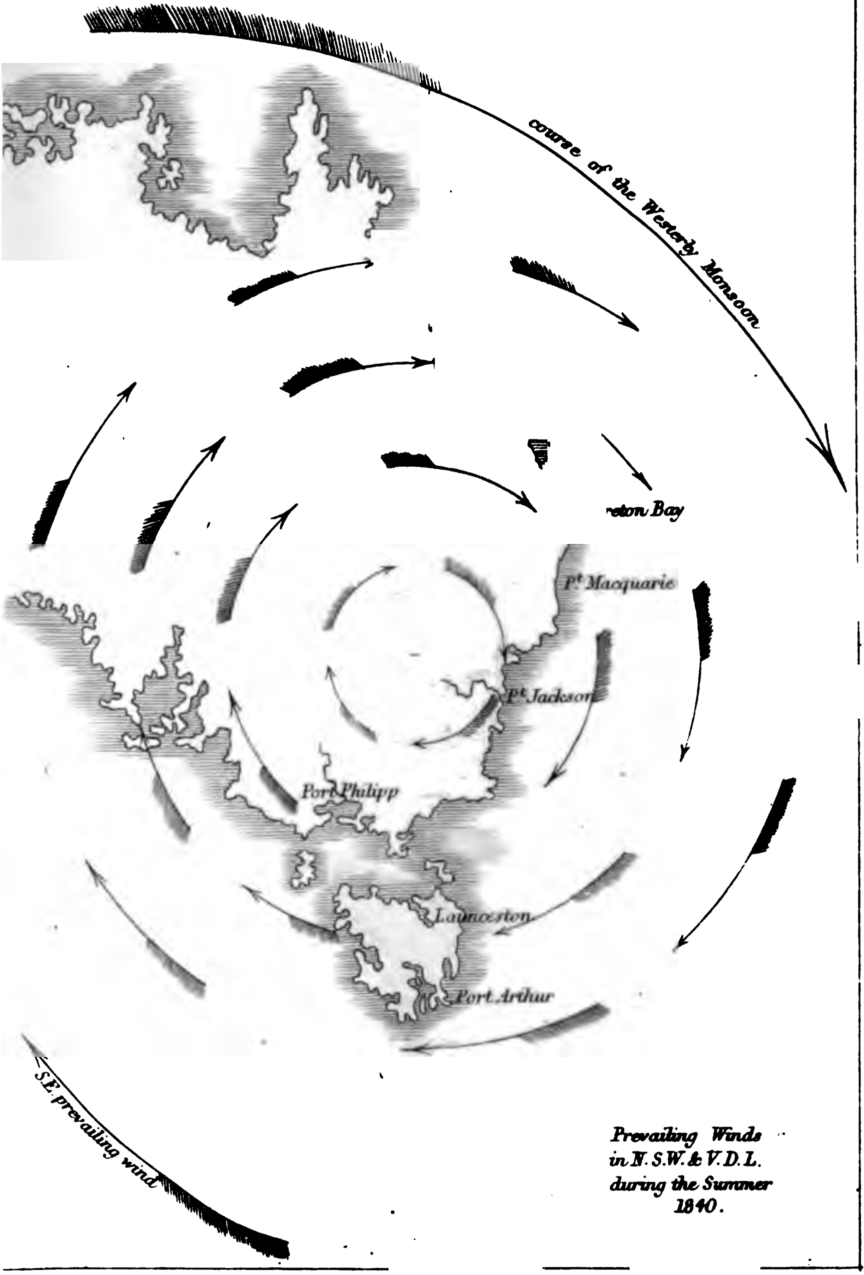
Fig. 2.



Prevailing Winds
in N.S.W. & V.D.L.
during the Winter
1840-1841-1842.

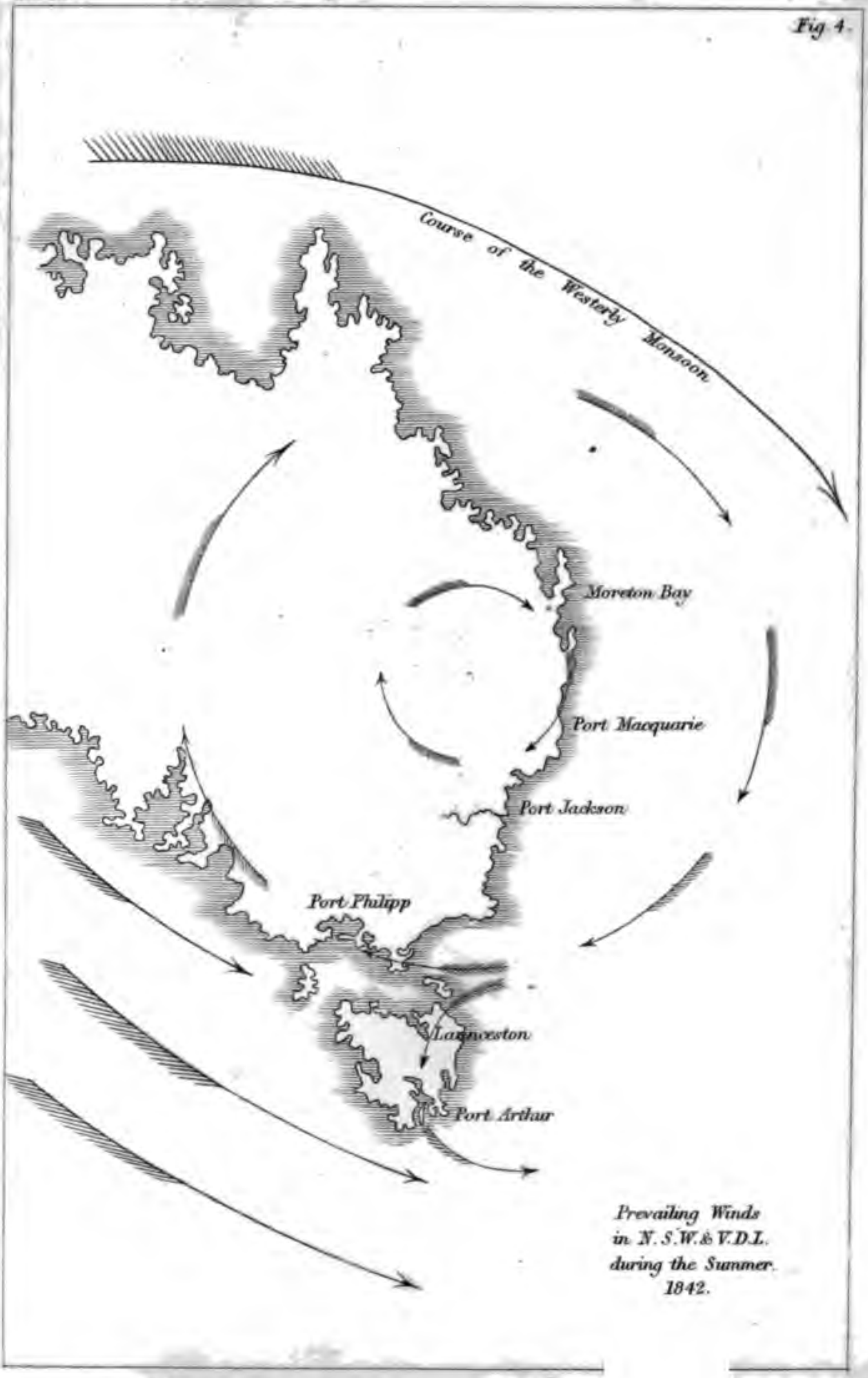
L. III.

Fig.



Prevailing Winds
in N.S.W. & V.D.L.
during the Summer
1840.

Fig 4.



Prevailing Winds
in N. S. W. & V. D. L.
during the Summer.
1842.

Plate 5.

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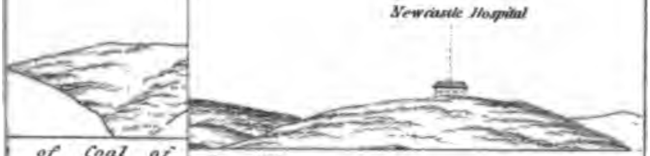

of Coal of

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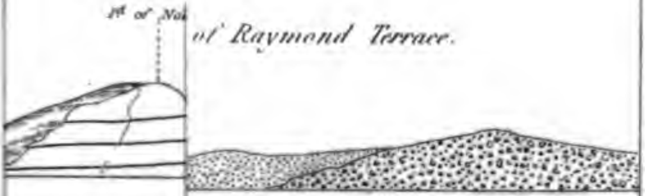

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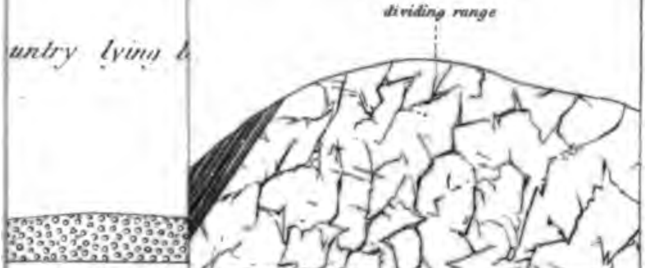

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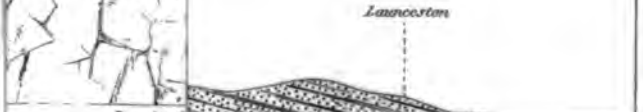

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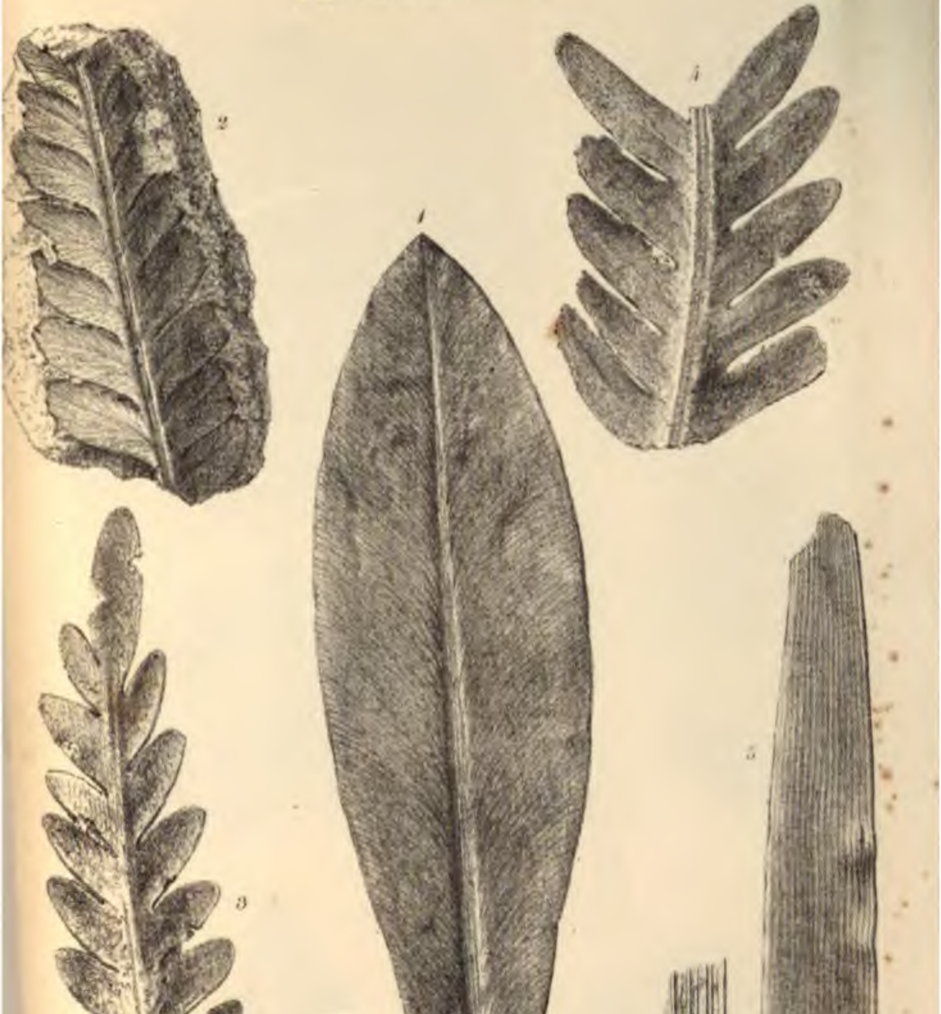

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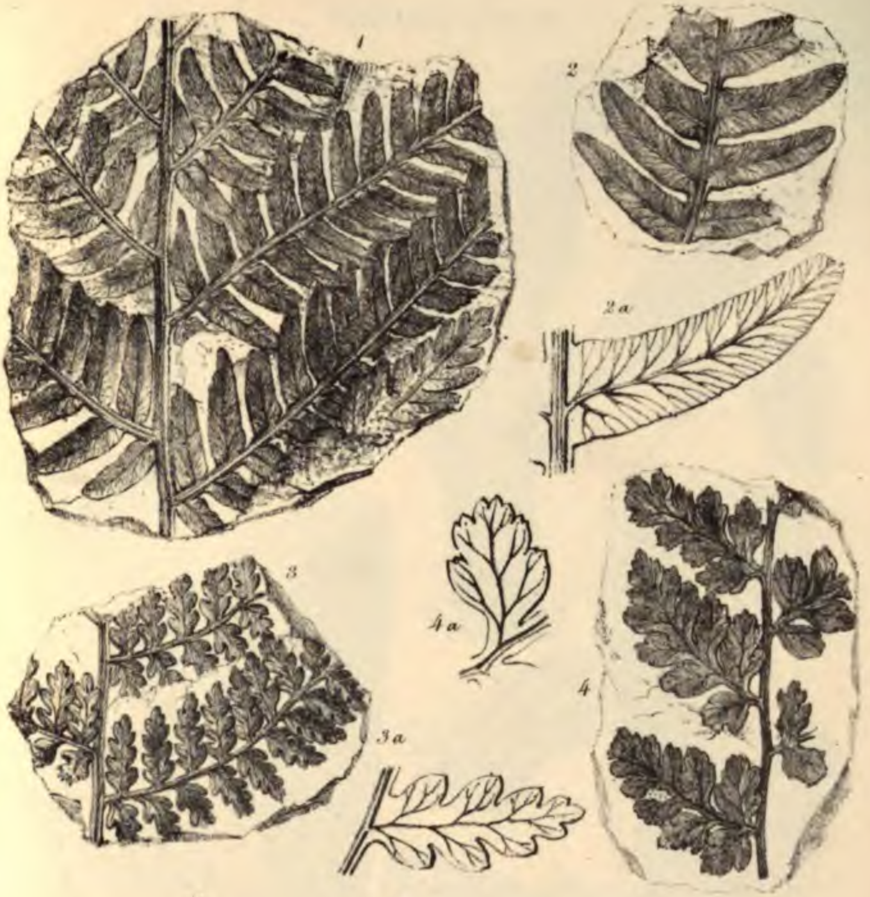

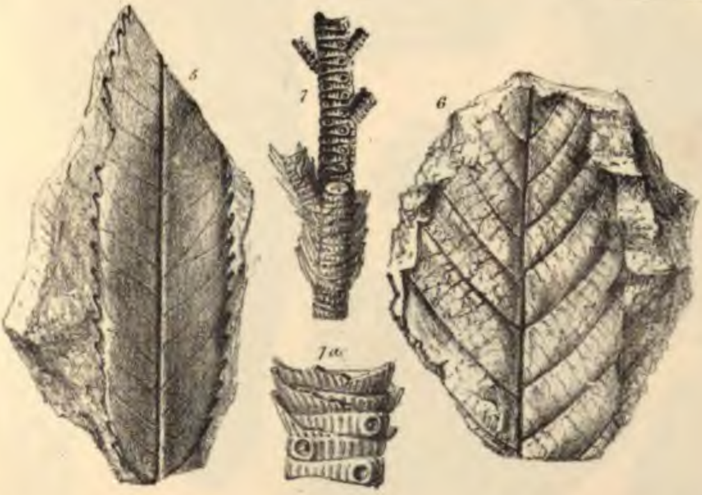

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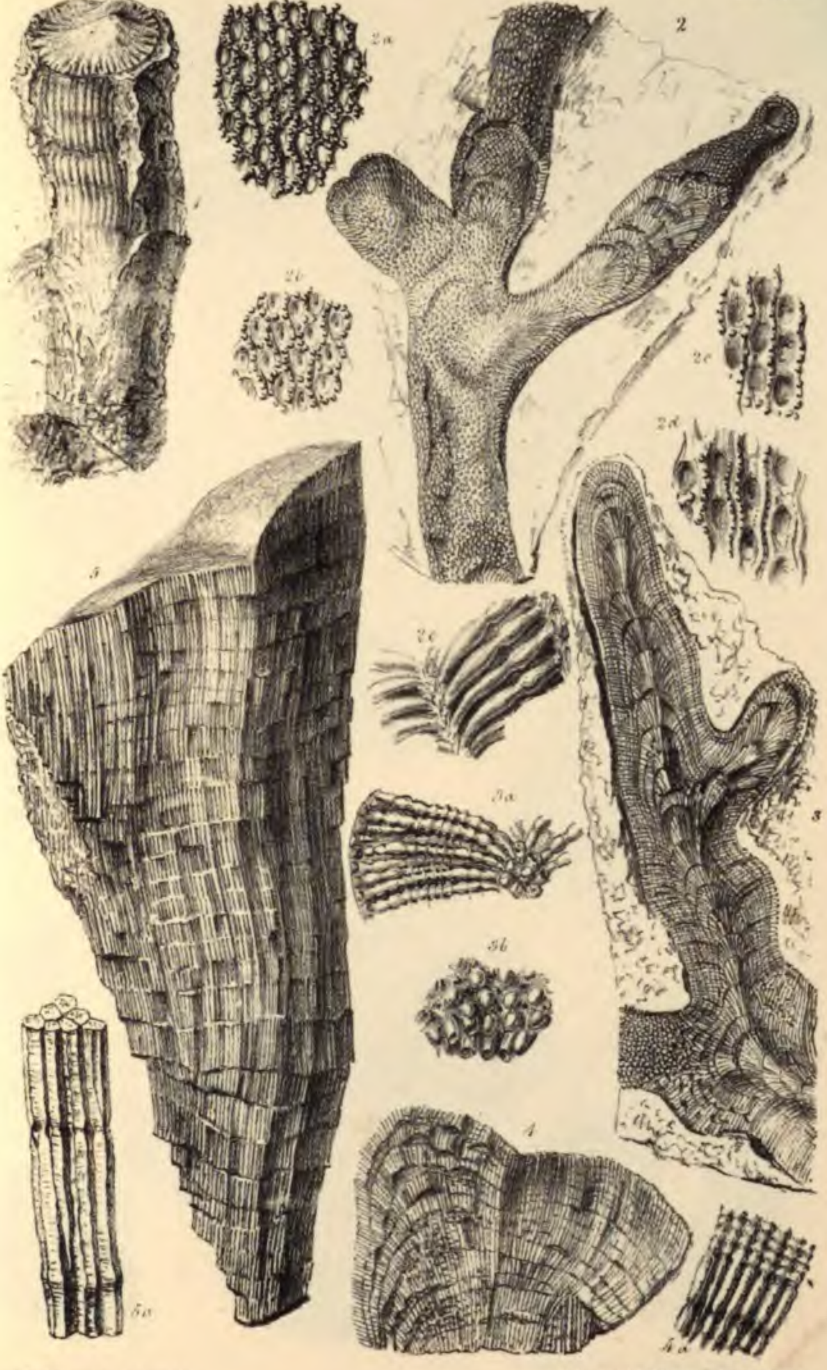
Pl. VIII.



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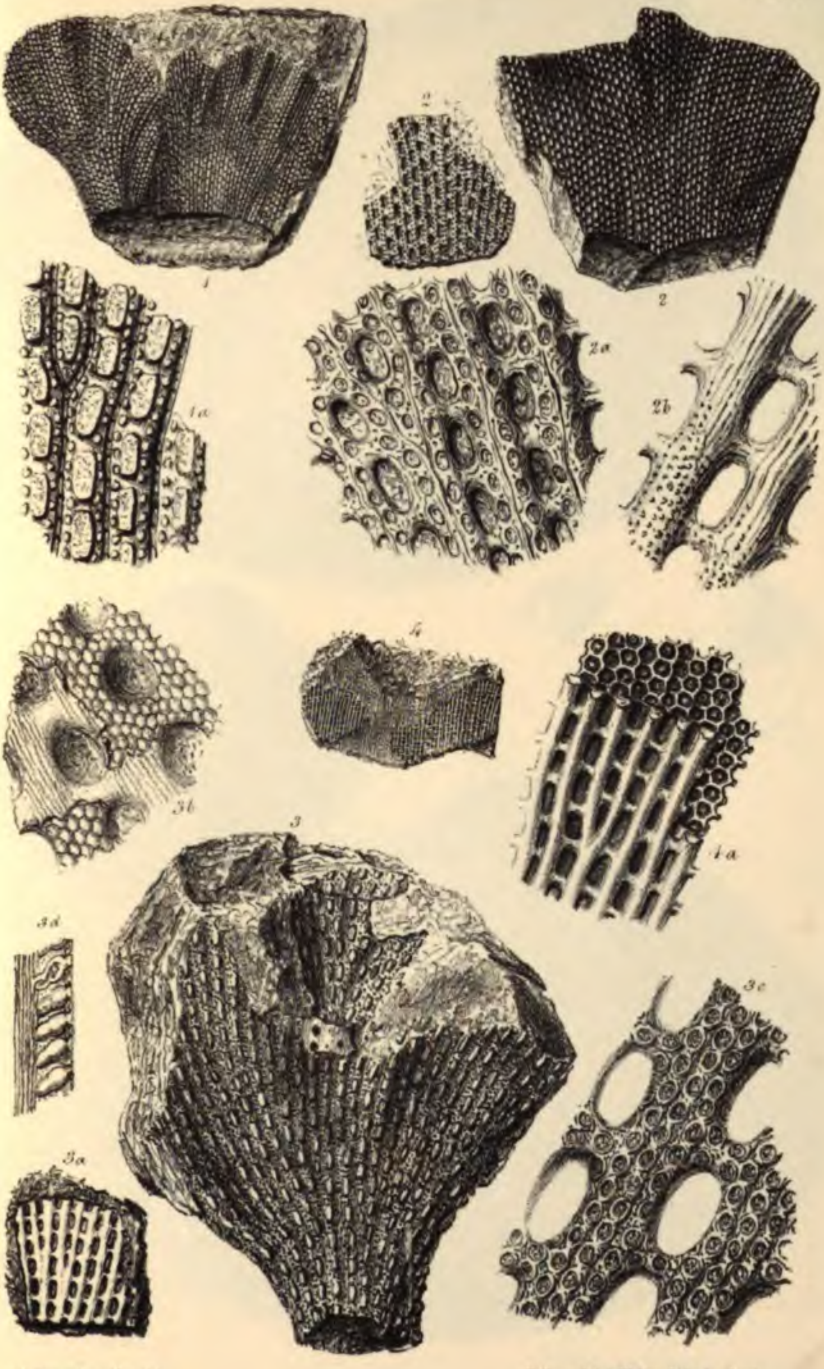

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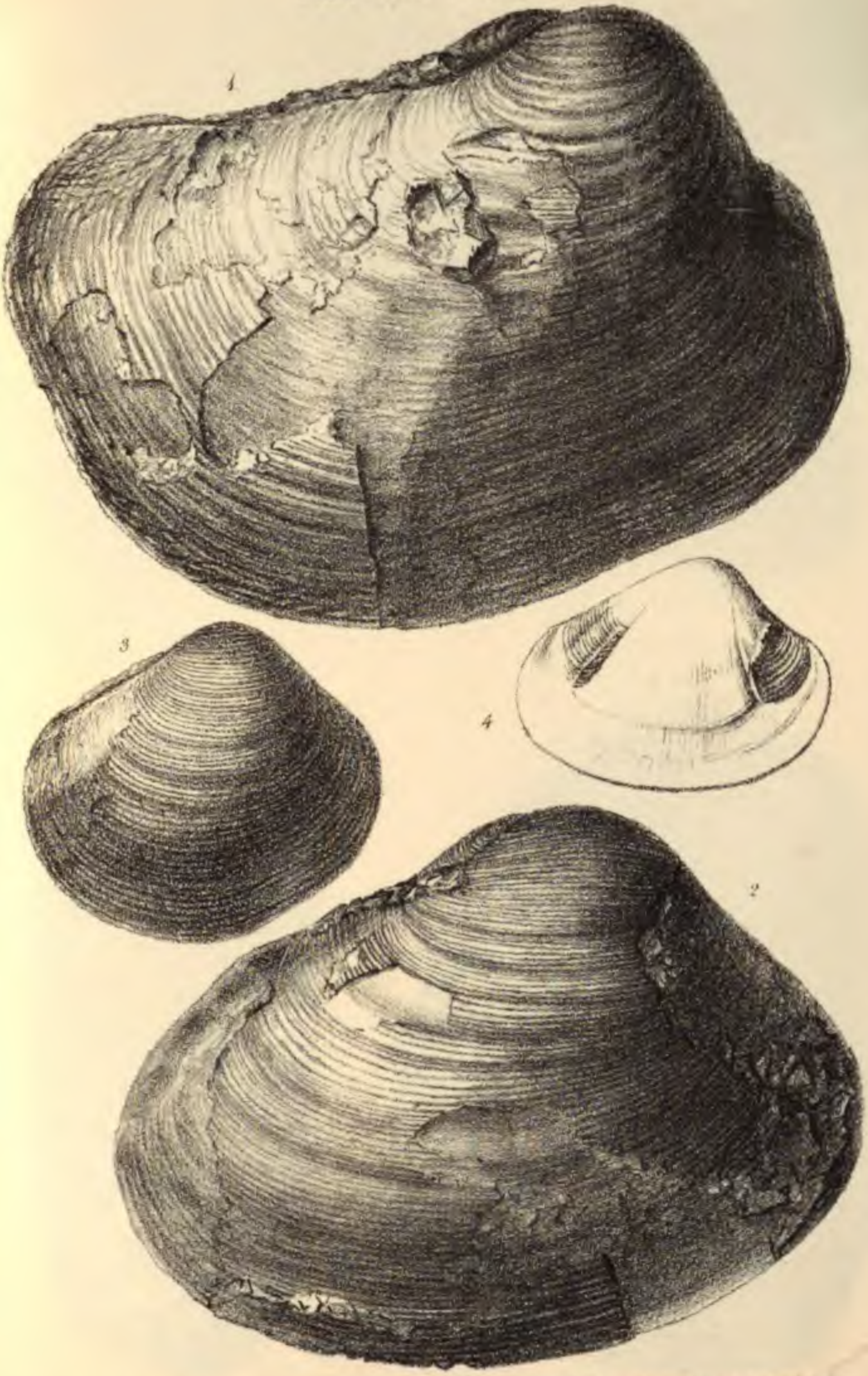

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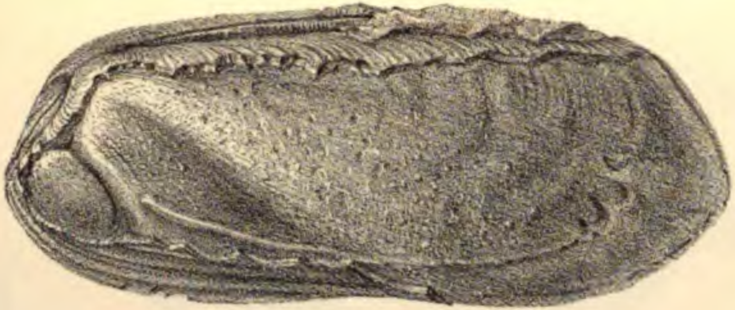

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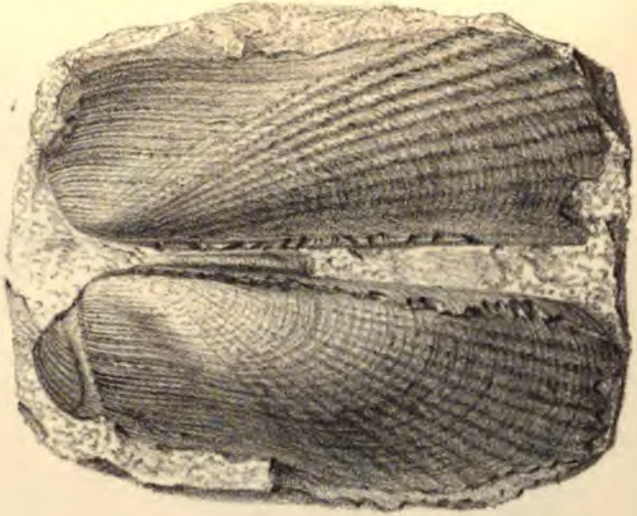

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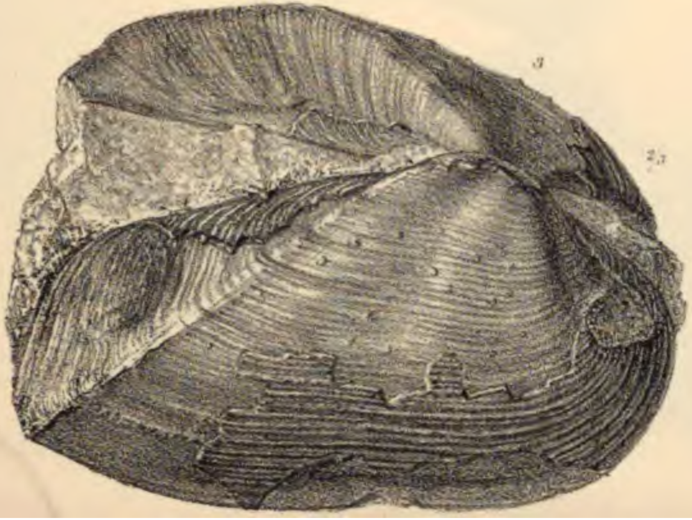

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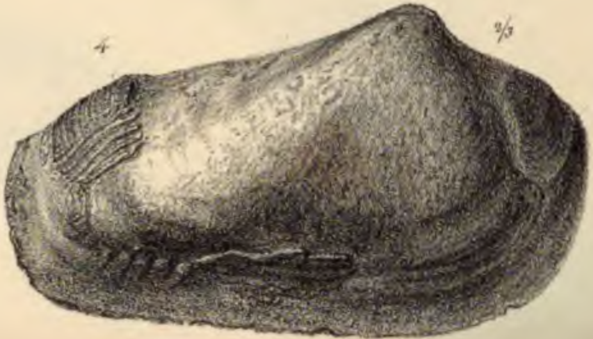

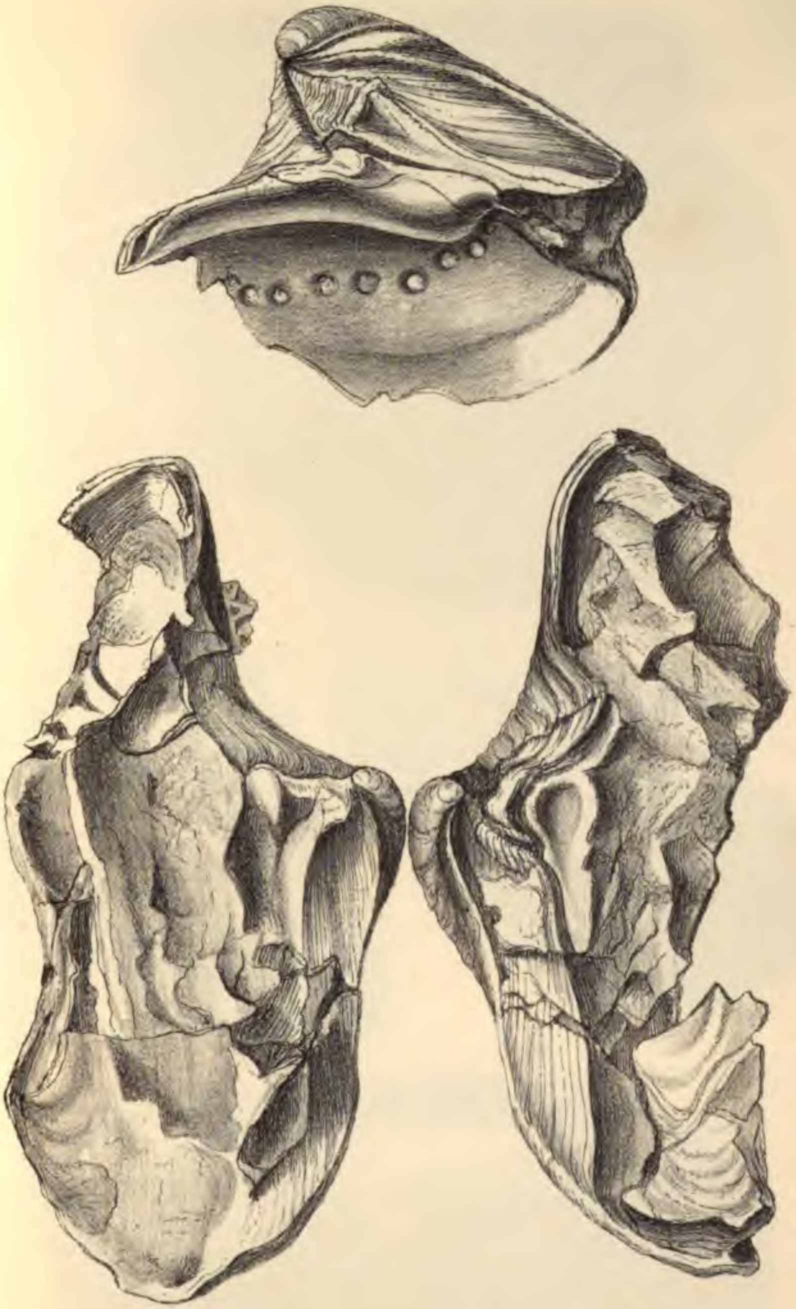

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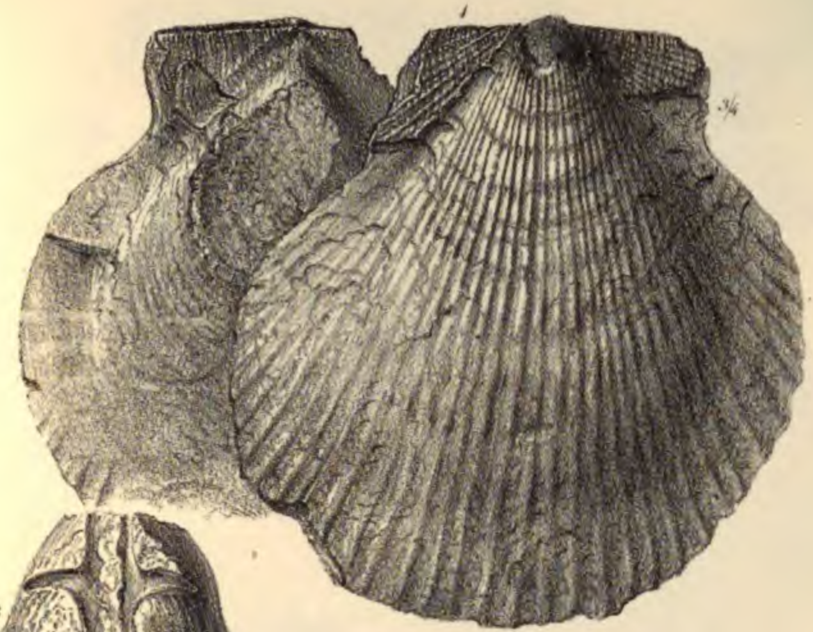

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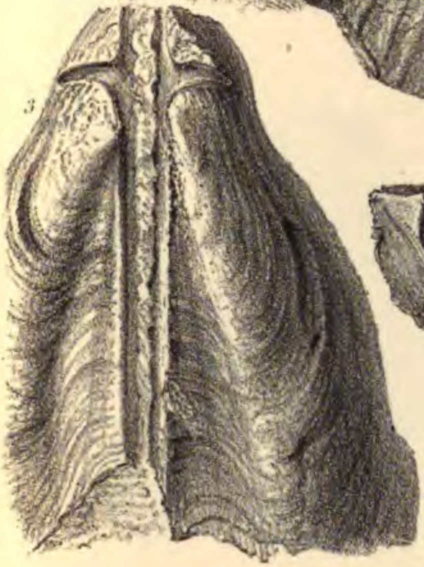

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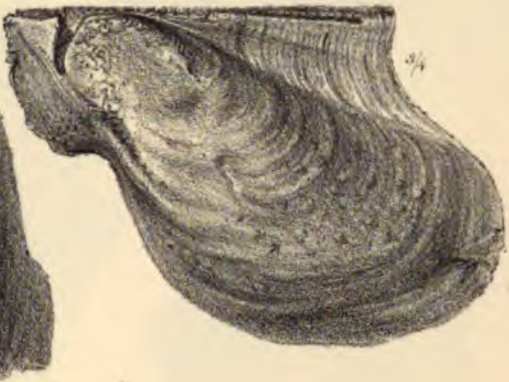

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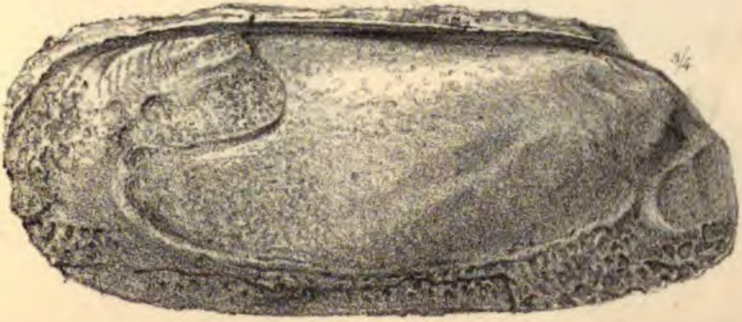

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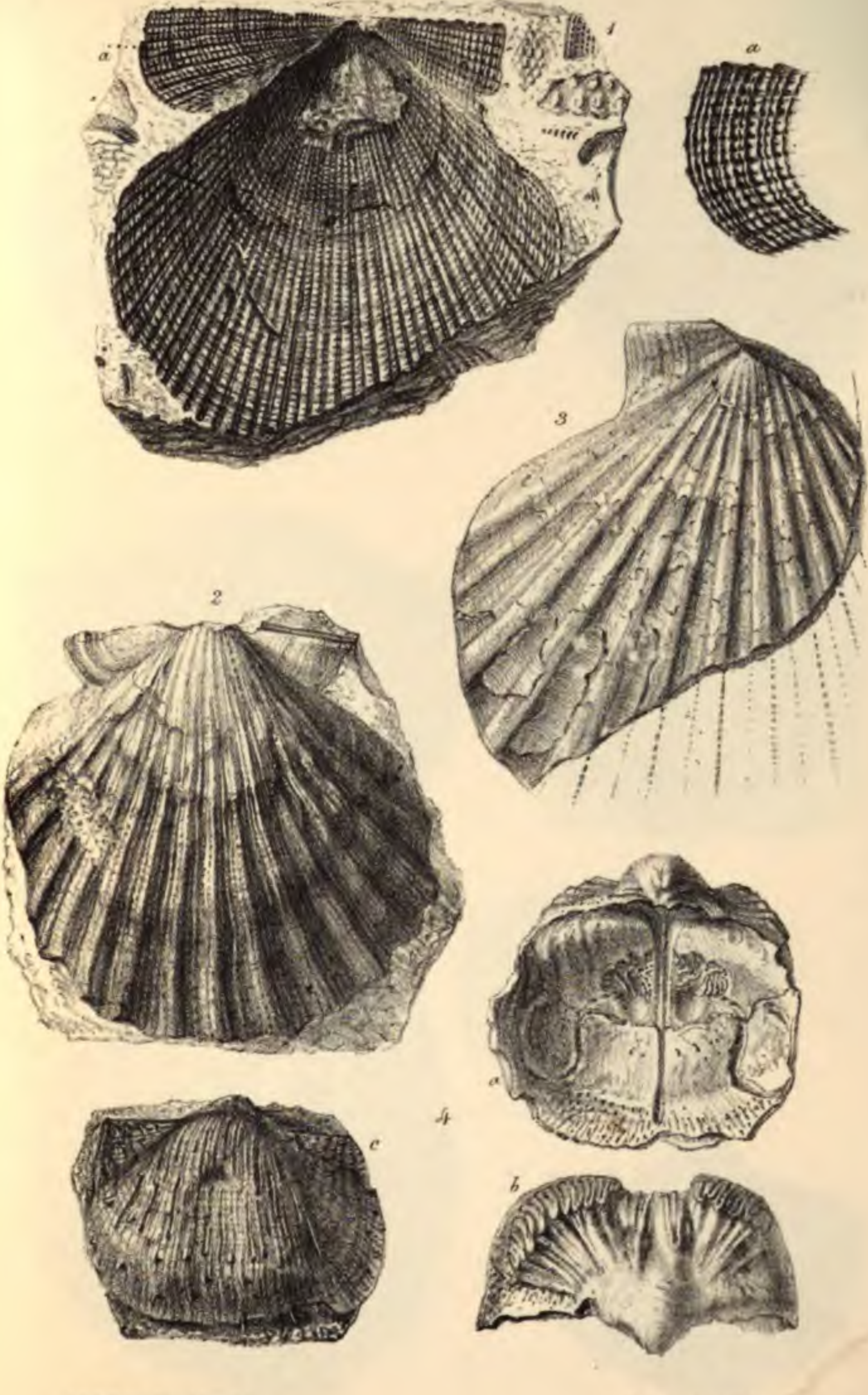

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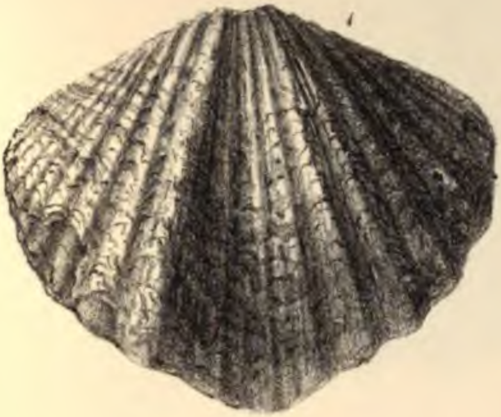

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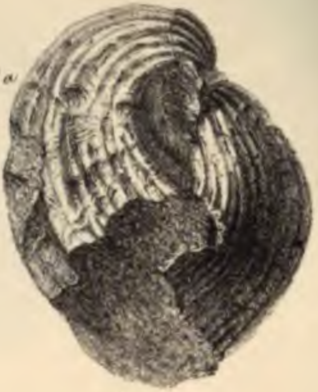

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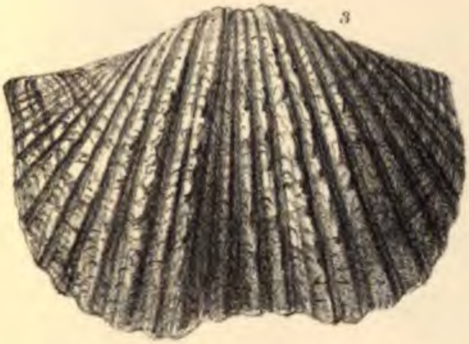

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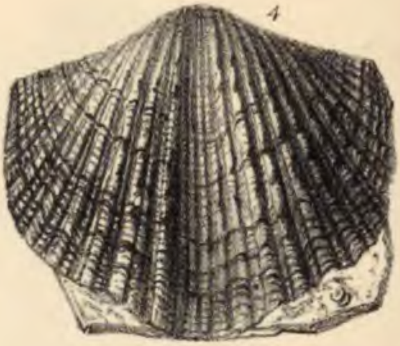

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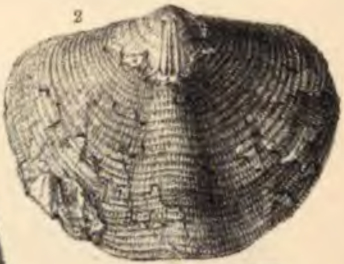

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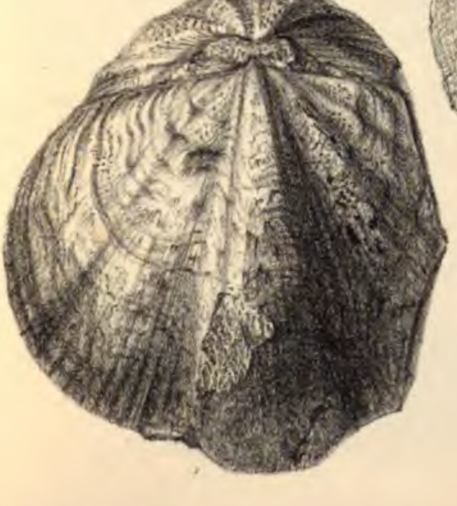

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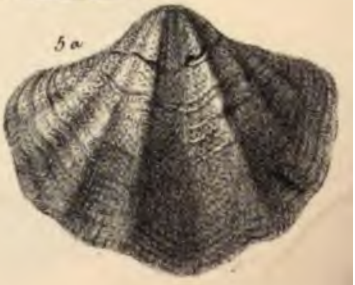

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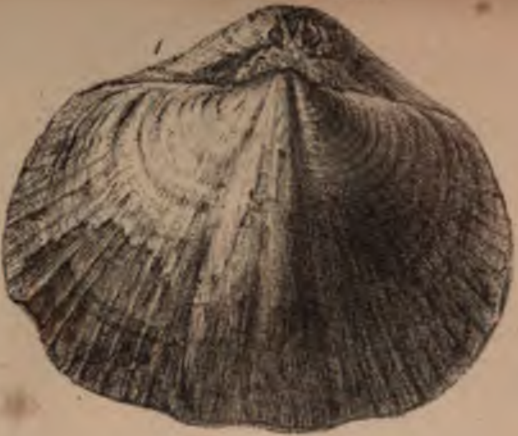

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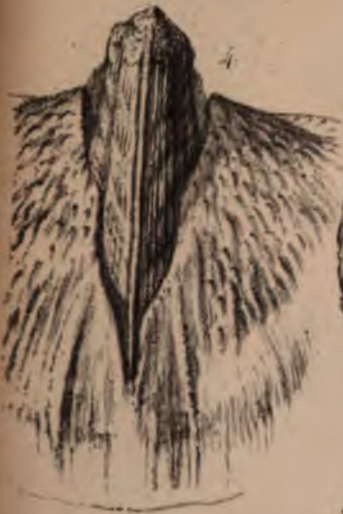

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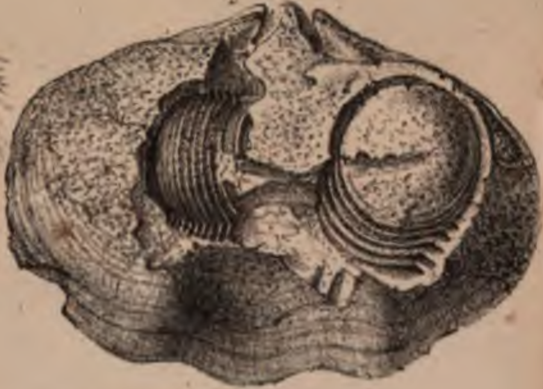

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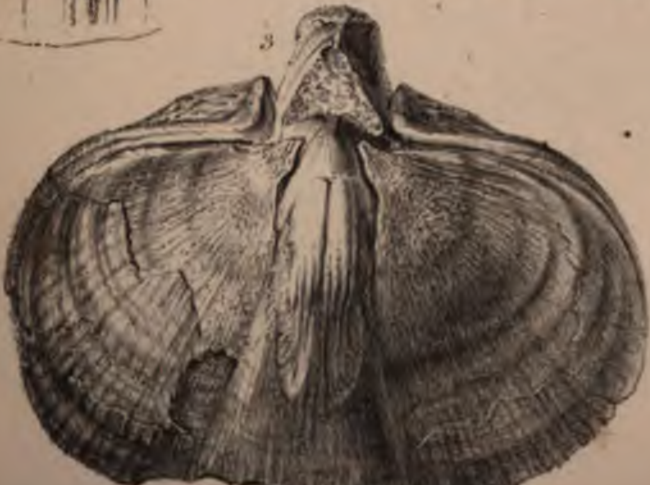

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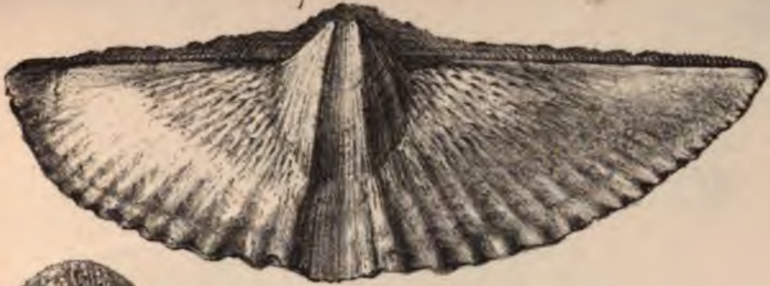

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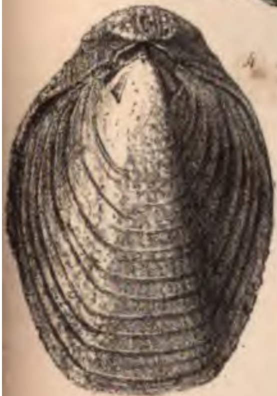

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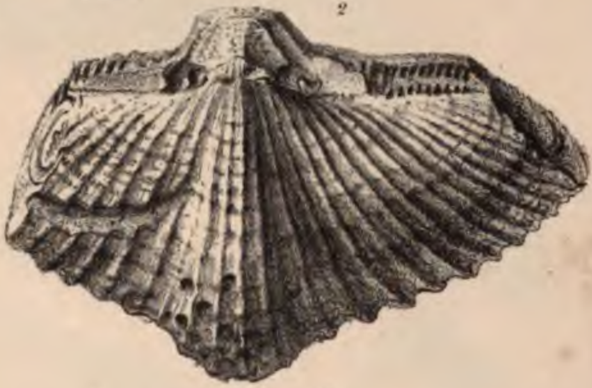

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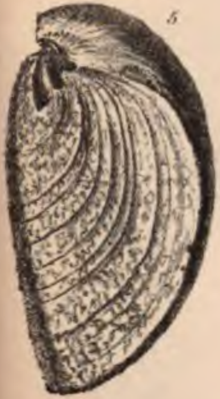

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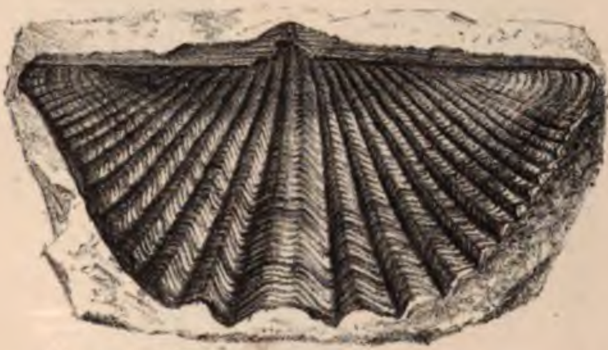

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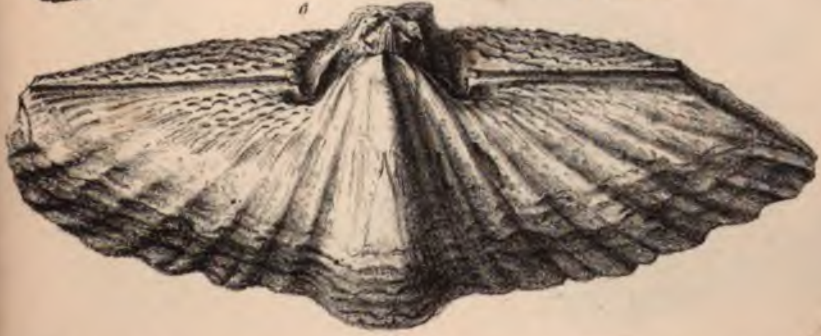

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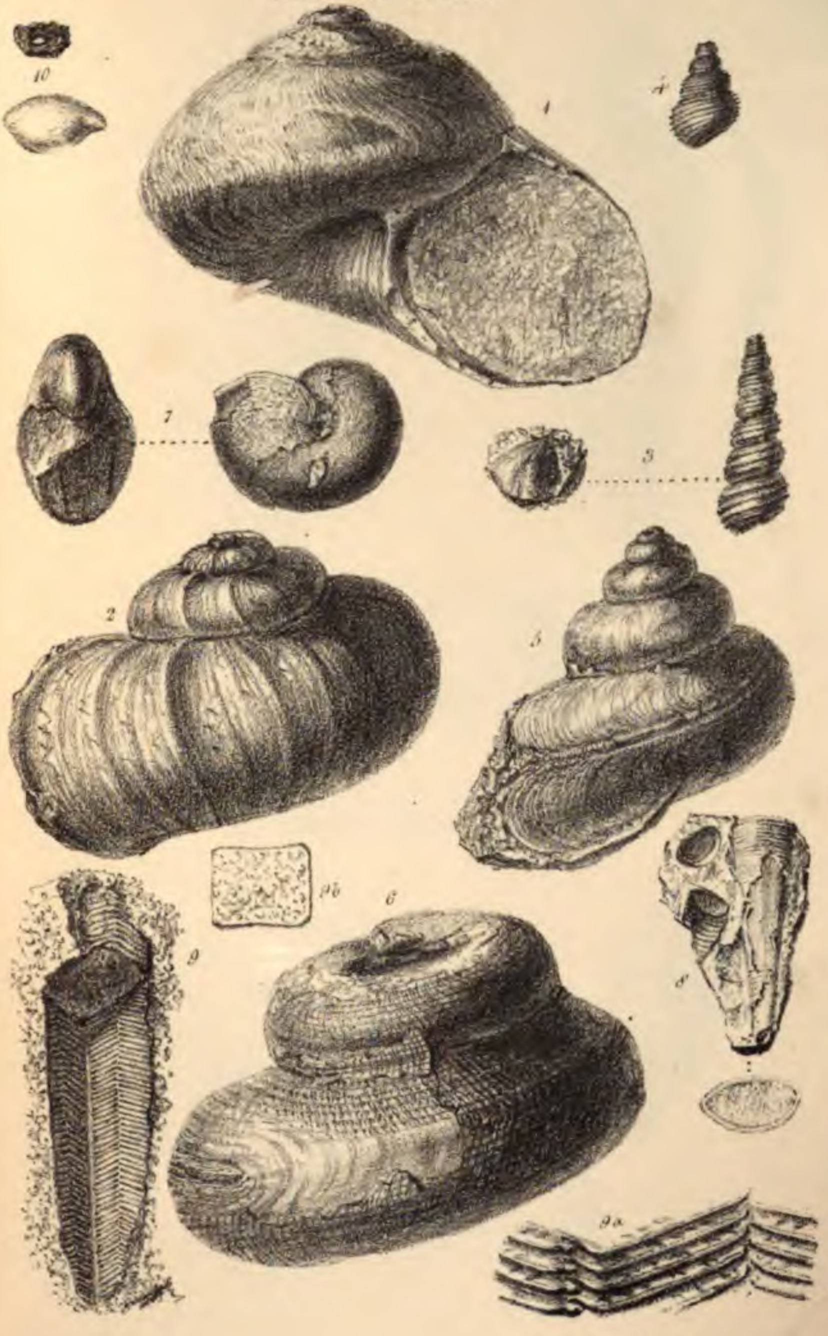
Pl. XVIII.

Palæozoic Series.



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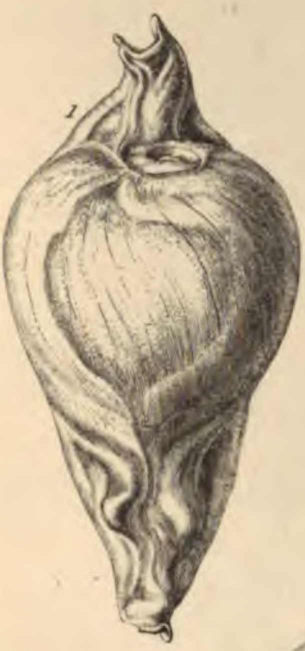

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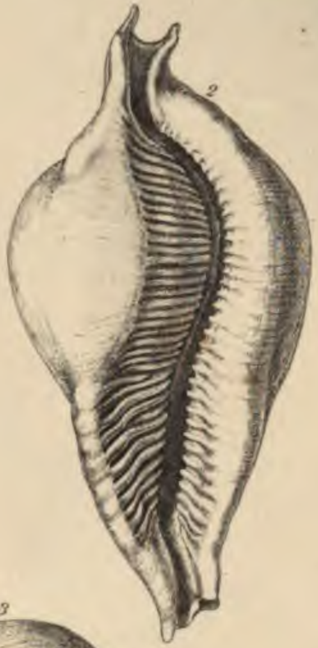

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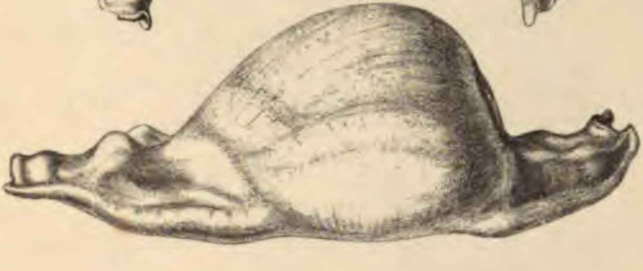

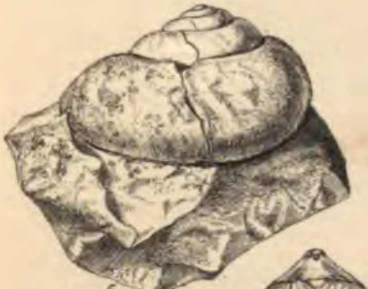

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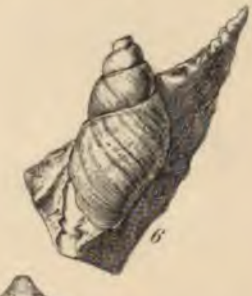

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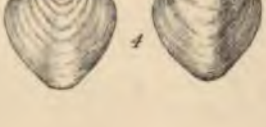

4

Cypræa eximia. f. 1. 2. 3.
Terebratula compta f. 4.

Bulinus Gunnii f. 5.
Helix Tasmaniensis f. 6.

G. B. Sowerby fecit.

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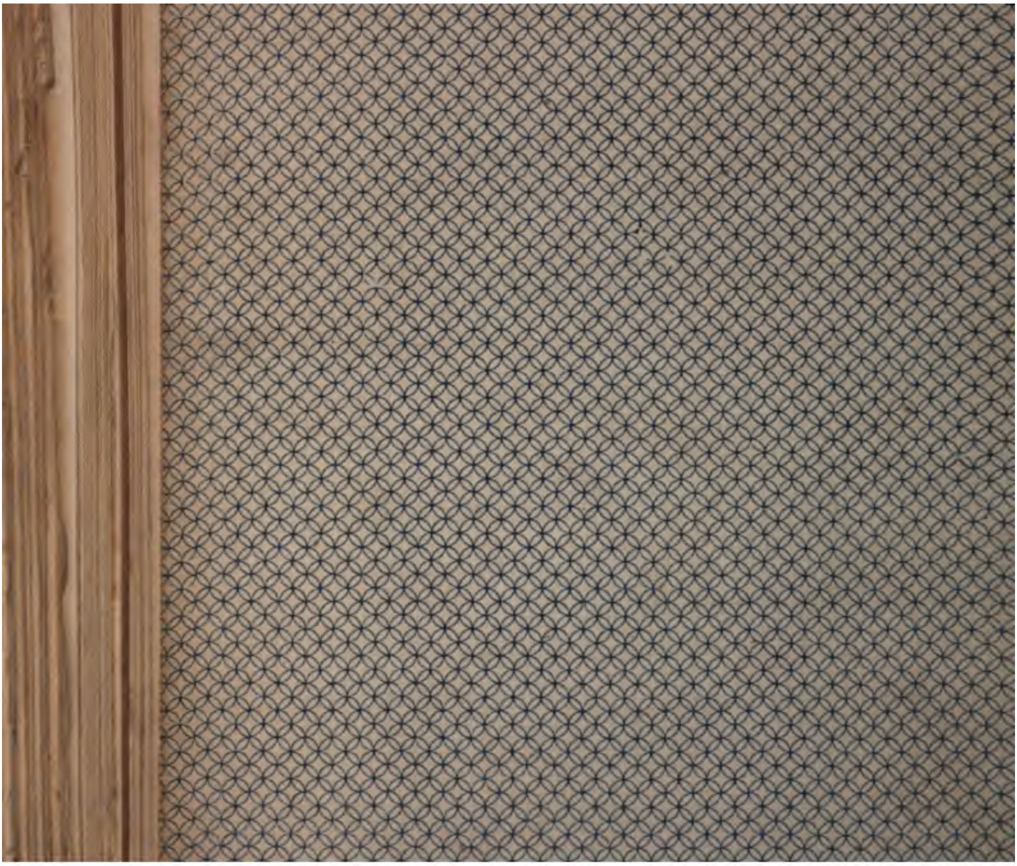

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